Vegetative Community Mapping of the Kissimmee River Floodplain Before and After Canalization

Division of State Planning, Tallahassee, Florida

A report to the Division of State Planning for the special project to prevent the eutrophication of Lake Okeechobee

KISSIMMEE RIVER FLOODPLAIN VEGETATION AND CATTLE CARRYING CAPACITY BEFORE AND AFTER CANALIZATION

Prepared By

Buford C. Pruitt
and
Stephen E. Gatewood

This report is one of the research reports commissioned by the Florida Division of State Planning as part of the Special Project to Prevent the Eutropication of Lake Okeechobee. This research and others commissioned by the Department of Environmental Regulation and the Central and Southern Florida Flood Control District form the basis for the Special Project final report and management plans.

State of Florida
Department of Administration
Division of State Planning
Bureau of Comprehensive Planning

January, 1976

Table of Contents

List of Tables

INTRODUCTION

In December of 1974, the Division of State Planning initiated work to map the vegetative communities of the Kissimmee River Floodplain. Objectives were to: (1) quantify acreage and patterns of various marsh communities in the floodplain prior to canalization, (2) quantify acreage and patterns of remaining marsh, improved pasture and upland vegetation that has invaded the floodplain since canalization, (3) assess vegetative trends in the floodplain due to canalization, and (4) apply vegetative acreages to an estimation of total floodplain cattle carrying capacity under pre- and post-canalization conditions.

Results provide baseline information for understanding the natural floodplain ecosystem and quantitative data to evaluate the various reflooding alternatives. Acreage of the various floodplain vegetative communities before and after canalization are multiplied by the approximate cattle stocking rates for each vegetative community to estimate total cattle carrying capacity for the floodplain under both regimes. Acreage figures were used for quantitative evaluations of areas to be reflooded.

Research Procedure

Natural and cultural habitats of the Kissimmee River Floodplain were outlined on acetate overlays from Agricultural Stablization and Conservation Service aerial photographs at a scale of 1:12,000, which were before (1952-54) and after (1974) construction of Canal C-38. After ground truthing, blueprinted copies of each habitat were cut out and tabulated by an automatic area meter (Model AAM-5, Hyashi Denko Co., Tokyo, Japan) to derive acreages. Recommended cattle carrying capacities for the various habitats were derived from Soil Conservation Service Range Technicians Guides, the Gatewood and Cornwell (1975) study of the Kissimmee Basin cattle industry and Dr. L.D. White (pers. communication, 1975).

The floodplain area quantified lies south of State Highway 60 and north of State Highway 70, between the original upland vegetative habitats as interpreted from aerial photographs. Sloughs and streams were excluded upstream from their junction with the floodplain. The area north of the old "Government Cut," extending about 7 miles upstream from Lake Okeechobee was excluded as it existed in 1954 and had already experienced changes due to canalization, changing little in land use from 1954 to 1974.

Five generalized vegetative communities were identified from pre-canalization (1954) aerial photos. Two additional habitats were identified from post-canalization (1974) aerial photos (Table 1). These habitats were defined as follows:

Improved pasture - pastureland managed for a few selected species of tame forage grasses after completion of drainage and removal of native vegetation. The most commonly used pasture grasses are bermudagrass (Cynondon dactylon), bahiagrass (Paspalum notatum), pangolagrass (Digitaria decumbens), and their varieties. Pastures are often separated from surrounding habitats through ditching and/or diking practices.

Unimproved pasture - pastureland which contains a mixture of forage and non-forage species, both native and introduced. Some representative taxa are carpetgrass (Axonopus spp.), panic grasses (Panicum spp.), paspalums (Paspalum spp.), bluestems (Andropogen spp.), sedges (Carex spp. and Cyperus spp.) and such forbs as pennywort (Centella asiatica) and dogfennel (Eupatorium spp.) It may contain some shrub species such as salt bush (Baccharis halmifolia) and wax myrtle (Myrica cerifera), usually as scattered individuals or in small patches. Drainage control is minimal.

Shrubby pasture - grassland pasture covered with 15-20 percent or more of shrub species. This habitat occurs where shrub species such as wax

myrtle and salt bush have invaded pastures adjacent to upland habitats and is used as a relative measure of shrub invasion into 1954 pasture.

Marshland - areas including both herbaceous and mixed shrub wetlands and characterized by one or more of the following taxa:

Maidencane	Panicum hemitomon
Cutgrasses	Leersia spp.
Watergrass	Hydrochloa caroliniensis
Sedges	Cyperaceae
Rushes	Juncaceae
Cattail	Typha spp.
Pickerel weed	Pontederia spp.
Arrowhead	Saggitaria spp.
Primrose willow	Ludwigia spp.
Willow	Salix spp.
Buttonbush	Cephalanthus occidentialis
Elderberry	Sambucus canadensis

Shrubland - areas with a relatively dense shrub capopy, approximately 50 percent coverage or greater. This classification includes both wet and dry shrub vegetation types.

Open water and disturbed habitats (ruderal) - areas including the Kissimmee River and its backwaters and tributaries, Canal C-38 ponds, numerous large ditches and dikes, levees, highway and railroad rights-of-way and buildings with their immediate surroundings.

Spoil areas - deposits of spoil dredged in construction of C-38, much of which is barren and supports little or no vegetation. Acreages of grazeable spoil are included in Table, 1, which lists acreage of

floodplain vegetative communities in pre- and post-canalization periods.

The habitats are outlined in Figures 2a and b through 20a and b, and are arranged with corresponding floodplain segments of pre- and post-canalization conditions in Appendix A.

Cattle carrying capacity estimates reported are approximations based on Soil Conservation Service recommended stocking rates for floodplain vegetation associations, expressed as the number of acres required to sustain one cow for a year. These are the best available rates. Each habitat type has a range of values which depends on its condition class, judged as excellent, good, fair or poor. Since determination of conditions class was not possible, Table 2 presents maximum and minimum stocking rates from excellent and poor condition classes, respectively. The computed cattle carrying capacity is the value derived using the median of the two extremes. This would correspond to an "average" condition class being applied to all habitats.

The stocking rates presented are estimates based on the amount of forage produced by the major vegetation associations identified. Each association is composed of various communities within the major grouping. For example, marshland is composed of numerous, intermingled wetland communities with different grazing values. Some are

TABLE I

Acreage of the vegetative communities of the Kissimmee River Floodplain in pre-(1954) and post-(1974) canalization periods.

Habitat	1954 Acres	1954 % of Total Acres	1974 Acres	1974 % of Total Acres	Change Acreage	Change %
1. Pasture						
a. Improved	900	1.4	15,400[1]	29.6	+14,500	+1,600
b. Unimproved	5,090	9.8	9,020[1]	17.4	+ 3930	+ 7.7
c. Shrubby	- -	- -	3,760[1]	7.2	+ 3,760	- -
Total	5,990	11.2	28,180	54.2	+22,190	+ 370
2. Marshland	40,600	78.2	8,840	17.0	-31,760	- 78
3. Shrubland	550	1.1	2,170	4.2	+ 1,615	+ 291
4. Open Water and Disturbed (Ruderal)	4,750	9.1	5,380	10.4	+ 630	+ 13
5. Spoil Areas						
a. In Pasture	- -	- -	1,300[1]	2.5	+ 1,300	- -
b. Unused	- -	- -	7,380	14.2	+ 7,380	- -
Total	- -	- -	8,680	16.7	+ 8,680	- -
Totals	51,890	- -	51,950	- -	- -	- -

[1]Acreage of spoil area pasturage included in above (1(a-c)) pastures.

TABLE 2

Estimated cattle carrying capacity for the Kissimmee River Floodplain vegetative communities, in pre-(1954) and post-(1974) canalization periods.

Habitat	1954 Acreage	1954 Acres Per AU	1954 Computed Cattle Carrying Capacity (Number of AU)[1]	1974 Acreage	1974 Acres Per AU	1974 Computed Cattle Carrying Capacity (Number of AU)
1. Pasture						
a. Improved	900	1- 5	300	15,400	1- 5	5,130
b. Unimproved	5,090	5-15	510	9,020	5-15	900
c. Shrubby	- -	- -	- -	3,760	5-15	380
Total	5,990	- -	810	28,180	- -	6,410
2. Marshland	40,600	2-12	5,800	8,840	2-20	800
3. Shrubland	550	5-20	40	2,170	5-20	170
4. Open Water and Disturbed (Ruderal)	4,750	- -	- -	5,380	- -	- -
5. Spoil Areas						
a. In Pasture	- -	- -	- -	1,300[2]	- -	- -
b. Unused	- -	- -	- -	7,380	- -	- -
Total	- -	- -	- -	8,680	- -	- -
Total	51,890[3]	- -	6,650	51,950[3]	- -	7,380[4]

1. Estimations in this column are median values as described in the text
2. Cattle carrying capacity included in 1(a-c) above
3. Error in acreage values computed at 0.053%
4. Increase of 11%

dominated by preferred forage plants (maidencane, cutgrass), while others by low value plants (cattail, pickerelweed). The range condition class is based on the abundance of preferred forage species for that habitat as follows:

Class	Precent of Present Vegetation Potential of Site
Excellent	76-100
Good	51-75
Fair	26-50
Poor	0-25

Thus, using a median value between excellent and poor stocking rates assumes that high and low forage value areas balance each other out to an "average" condition.

It should be emphasized that all of the area in question has not been used necessarily for cattle production in the past. However, for the purpose of estimating total floodplain carrying capacity it is assumed that all grazeable acreage could be utilized, including land from which cattle are presently excluded by fences, the river, deep marsh water or canals. Values for carrying capacities are estimated from the total acreage of vegetative habitats for the entire floodplain as if it were managed as one production unit.

Also of prime importance is consideration of the effects flood waters have on actual carrying capacity. The pre-canalization condition was characterized by seasonal flooding on the floodplain which affected cattle use. However, this occurred at a time when proper marsh

management calls for resting marsh pastures from grazing. High flood waters provided a natural deferment during the growing season, permitting perferred forage species to maintain vigor and reproduce. Forage production accumulated during limited access for subsequent grazing as flood waters receded. The change in actual carrying capacity due to high water could not be specifically quantified with the information available.

Determination of precise cattle carrying capacities for the floodplain is not possible without a parcel-by-parcel evaluation of the area. It is influenced by: (1) types and amount of forage produced, (2) previous management practices, (3) local variations in soils and corresponding vegetative cover, (4) ground elevation in relation to fluctuating water levels, and other factors (Gatewood and Cornwell, 1975). However, this technique provides an approximation based on the acreage of generalized vegetative communities identified and may be used for comparative purposes. Further quantification of the many interacting factors would permit more exact estimates of cattle carrying capacity, but are beyond the scope of this study.

Results and Discussion

Profound and obvious changes have occurred to Kissimmee River Floodplain vegetative communities since 1954. Construction of Canal C-38 with subsequent floodplain drainage and shifts in land management techniques have changed vegetative patterns completely. Marshland has been reduced by 78 percent. Pasture has increased by 370 percent, the majority replacing marshland. Spoil areas now cover 8,680 acres of former floodplain habitats.

Open water and ruderal acreages have increased little, yet their character has changed radically. Various aspects of this process of change have been further described by Goodrick and Milleson (1974), Gatewood and Cornwell (1975) and Marshall, et. al. (1972).

The 1954 riverine marshland averaged one mile wide and covered 40,600 acres (63.4 square miles) which supported a number of vegetative communities. Large stands of maidencane and cutgrass were interspersed within the large community which included a diverse group of sedges, forbs, grasses and shrubs. Smaller marshes of similar composition were common in depressions along the floodplain fringes and where numerous creeks and sloughs entered the floodplain. Oxbow lakes and small, shallow ponds were plentiful.

Marshland by 1974 had been reduced to 8,840 acres (13.8 square miles). Most of this was confined to the five pools behind the control structures on C-38. Stablized water levels in the pools have created deep marshes which differ from those present under fluctuating water levels.* Cattle prefer not to forage in deeper areas of the pools due to deep water year-round. Subsequently, emergent vegetation is very tall and dense.

*Some pools are now being fluctuated approximately one foot on an annual basis (Goodrick and Milleson, 1974).

Pasture vegetation in 1954 was confined to 5,990 acres of the floodplain's higher fringes. About 85 percent of the pasture was unimproved, with cattle generally grazing on a seasonal basis depending on water levels.

Pasture in 1974 had been increased to 28,180 acres encompassing 54 percent of the floodplain. Improved pasture now occupied almost 30 percent of the floodplain, up from 1.4 percent in 1954. Pasture covered most of the land potentially available for intensive management by cattlemen and replaced large areas of former marshland.

Shrubland in 1954 was generally limited to natural river levvees and to occasional willow-buttonbush swamps along floodplain fringes and covered about 550 acres (1.1 percent) of the floodplain. There was very little invasion by upland shrubs into floodplain fringe pastures.

Shrubland had increased 291 percent to 2,170 acres by 1974. Shrubs occurred on agricultural and flood control levees, spoil areas and on some islands formed between the old riverbed and C-38. Shrubs had also invaded a large portion (74 percent) of fringe pastureland.

Open water and ruderal areas occupied 4,750 acres in 1954. Most open water was contained in the Kissimmee River, its oxbow lakes and by-passes, and numerous small ponds scattered throughout the floodplain. Ruderal areas consisted mostly of agricultural levees and railroad or highway rights-of-way.

Open water and ruderal had increased only 13 percent by 1974; however, its character had changed radically. Most open water was confined to the relatively slow moving waters of C-38

with its five impoundments and the larger former river channels. Ruderal areas increased with the addition of many new flood control and agricultural levees.

The spoil banks of dredged material from C-38 covered 8,680 acres of the floodplain. Within these banks were 7,380 acres of bare spoil supporting little or no vegetation. Herbaceous and shruby vegetation covered the remaining 1,300 acres.

From these changes in vegetative habitats it is estimated that the cattle carrying capacity of the floodplain in 1974 was increased only 11 percent over that which may have been possible under the pre-canalized system. This increase is due primarily to shifts in total acreage of marshland and improved pasture habitats. Marshland supported most of the cattle prior to canalization while the 1974 system carried most of the cattle on improved pasture.

The estimated number of cattle that could be carried on the vegetative habitats existing prior to canalization was 6,650 cows. This was increased to 7,380 under 1974 conditions, yielding average flood plain stocking rates of 7.8 acres/cow and 7.0 acres/cow, respectively.

Shifts in acreages of marshland and pasture had the most significant effect on total floodplain carrying capacity calculations. Marshland in 1954 carried 87 percent of the estimated load with pasture contributing 12 percent. In 1974, the increased acreage of pasture carried 87 percent of the estimated cattle with reduced marshland supporting 11

percent. As was expected, the roles of marshland and pasture for sustaining floodplain cattle have been exchanged as a result of canalization.

The character of grazing resources has changed along with actual acreages. The predrainage (1954) floodplain was characterized by seasonal flooding, which displaced cattle and provided a natural deferment from grazing for marshland habitats. The construction of C-38 water level control combined with the close proximity of remaining marshland to improved pastures established within the floodplain, provided cattle with year-round access to remaining marsh sites. This permits overgrazing of desireable native forages by the high cattle densities present on improved pasture and encourages the growth of plants with low forage value. The primary grazing resource has been changed from one of naturally maintained native forages to one of culturally maintained tame forages.

Overall conditions in the Kissimmee River Floodplain between 1954 and 1974 can be characterized by three major shifts in structure and function: (1) plant communities and land management techniques have been changed from systems requiring low energy inputs to systems requiring high energy inputs, (2) 1974 systems were culturalized totally, while 1954 systems were only partially culturalized, and (3) a floodplain marsh system with naturally maintained high productivity was replaced by a system of pastures with slightly higher, culturally maintained productivity.

The 1954 floodplain ecosystem was one of extensive marshes and grasslands grazed by free roaming cattle. This required very little machinery, low amounts of fossil fuels and little or no fertilizers. By 1974, conditions were such that large amounts of gasoline and fuels, much farm machinery and substantial amounts of fertilizers had been used in developing and maintaining the pasture ecosystem. It can be seen that large amounts of capital are required to sustain the present floodplain system.

The floodplain was only partially culturalized in 1954; that is, very little human influence was used to subsidize natural driving forces. Water levels were governed by basin rainfall and the hydrologic capabilities of the Kissimmee River. Nutrients were deposited by seasonally flooding river waters. Vegetation was controlled by natural water levels, periodic cattle grazing and limited human management. By 1974, as a direct result of construction of C-38, the floodplain had become completely culturalized. No aspect of its functioning escaped human influence. Water levels were dictated by human management policies. Most natural drainage patterns within the floodplain were altered by ditching. Fertilizers were being applied only to improved pastures while remaining areas no longer received nutrient enrichment by flood waters. Vegetation was controlled by manipulated water levels and through intensive management by land owners. Most natural driving forces in operation prior to canalization were no longer effective.

Natural communities, especially marshland, had high potential forage productivity for cattle. Desirable native forage was abundant or dominant in many locations. This natural system was estimated to have only slightly lower overall productivity (in terms of estimated cattle supported) than the 1974 system. While improved pasture was over twice as productive on a per acre basis as marshland, which is evidenced by the ability to carry almost as many cattle on less than half the acreage, the natural system maintained its productivity at far lower cost to man than is required to sustain present culturalized systems.

It thus appears that the increase in total floodplain cattle carrying capacity is estimated to be very low. This small increase may not be significant in light of the high costs incurred in establishing improved pastures and maintaining long term productivity. From a cost-benefit viewpoint, Canal C-38 may have actually had an adverse effect on cattle production in the Kissimmee River Floodplain by requiring substantial cultural subsidies to maintain productivity.

REFERENCES CITED

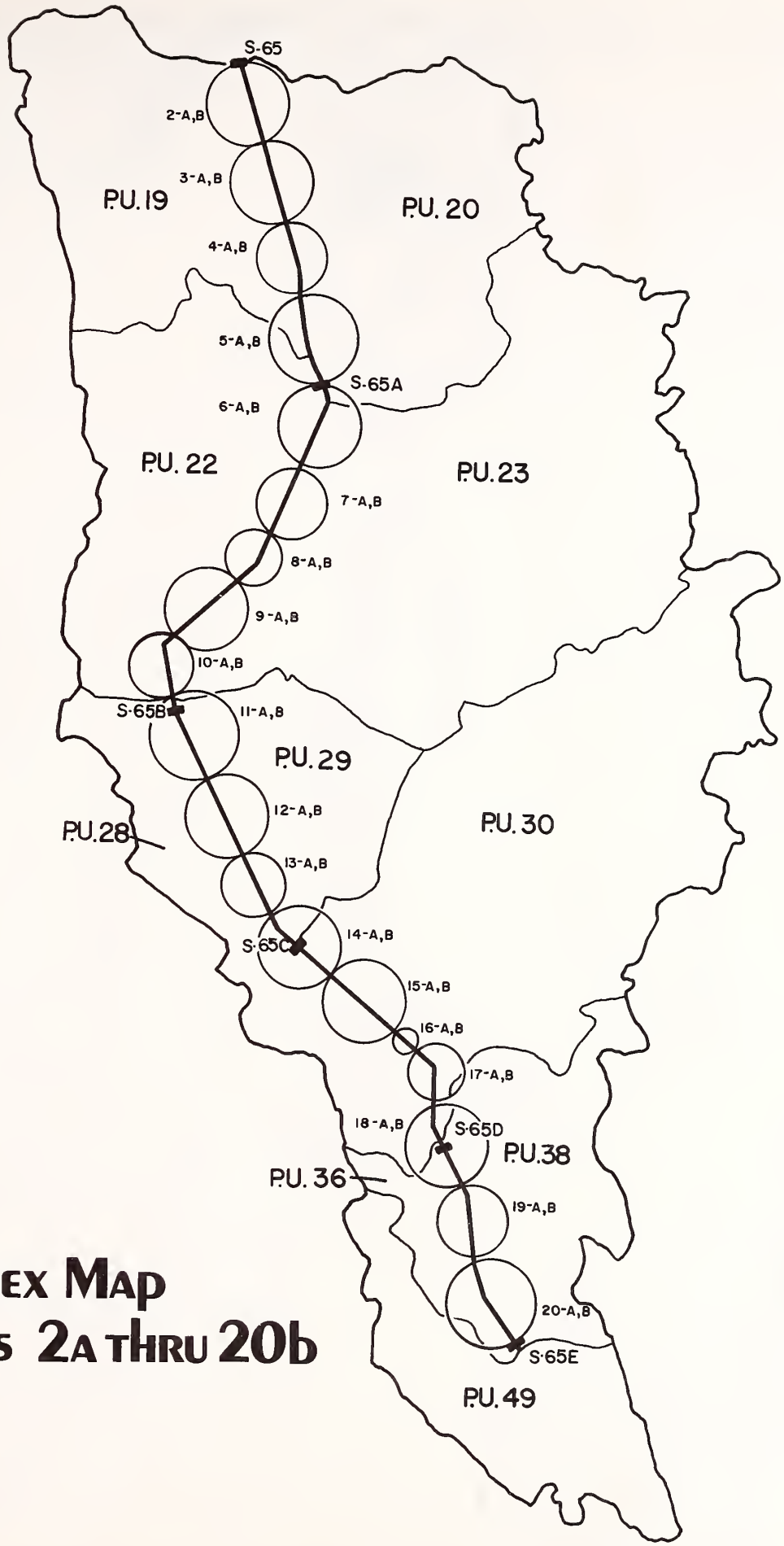
Gatewood, S. E. and G. W. Cornwell. 1975. An analysis of cattle ranching in the Kissimmee River Basin. Florida Department of Administration, Division of State Planning, Bureau of Comprehensive Planning.

Goodrick, R. L. and J. F. Milleson. 1974. Studies of flood-plain vegetation and water level fluctuation in the Kissimmee River Valley. Central and Southern Florida Flood Control District, March.

Marshall, A. R., et. al. 1972. The Kissimmee - Okeechobee Basin: A Report to the Cabinet of Florida. Division of Applied Ecology, Center for Urban and Regional Studies, University of Miami, December 12.

Appendix

Vegetative Communities Maps of the Kissimmee River Floodplain during Pre- and Post-Channelization Periods.



Index Map for figures 2A thru 20b

FIGURE 1

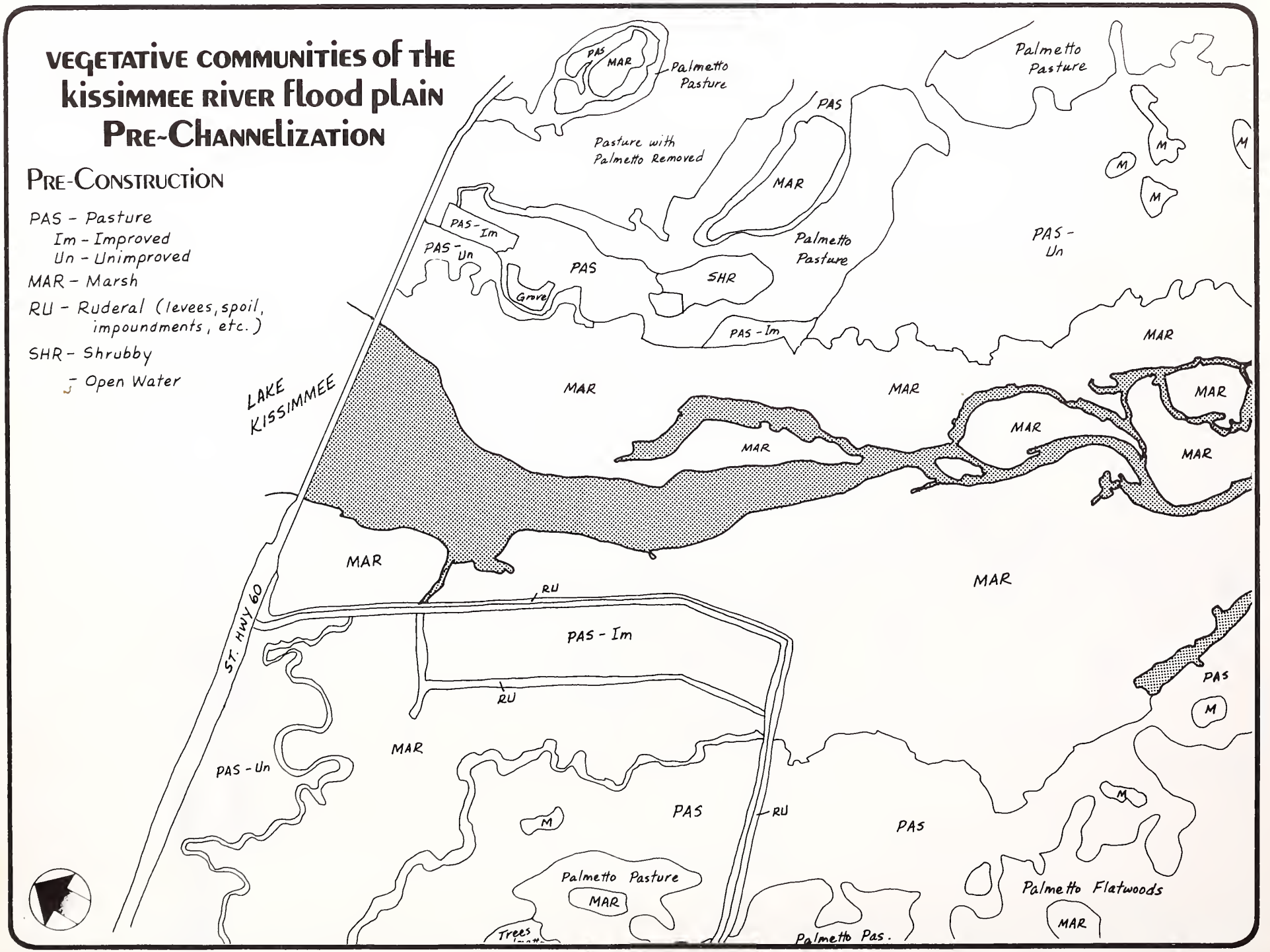

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
LAKE KISSIMMEE
ST. HWY 60
PAS
MAR
Palmetto Pasture
Pasture with Palmetto Removed
PAS - Im
PAS - Un
Grove
SHR
RU
M
Trees
Palmetto Flatwoods
Palmetto Pas.

FIGURE 2a

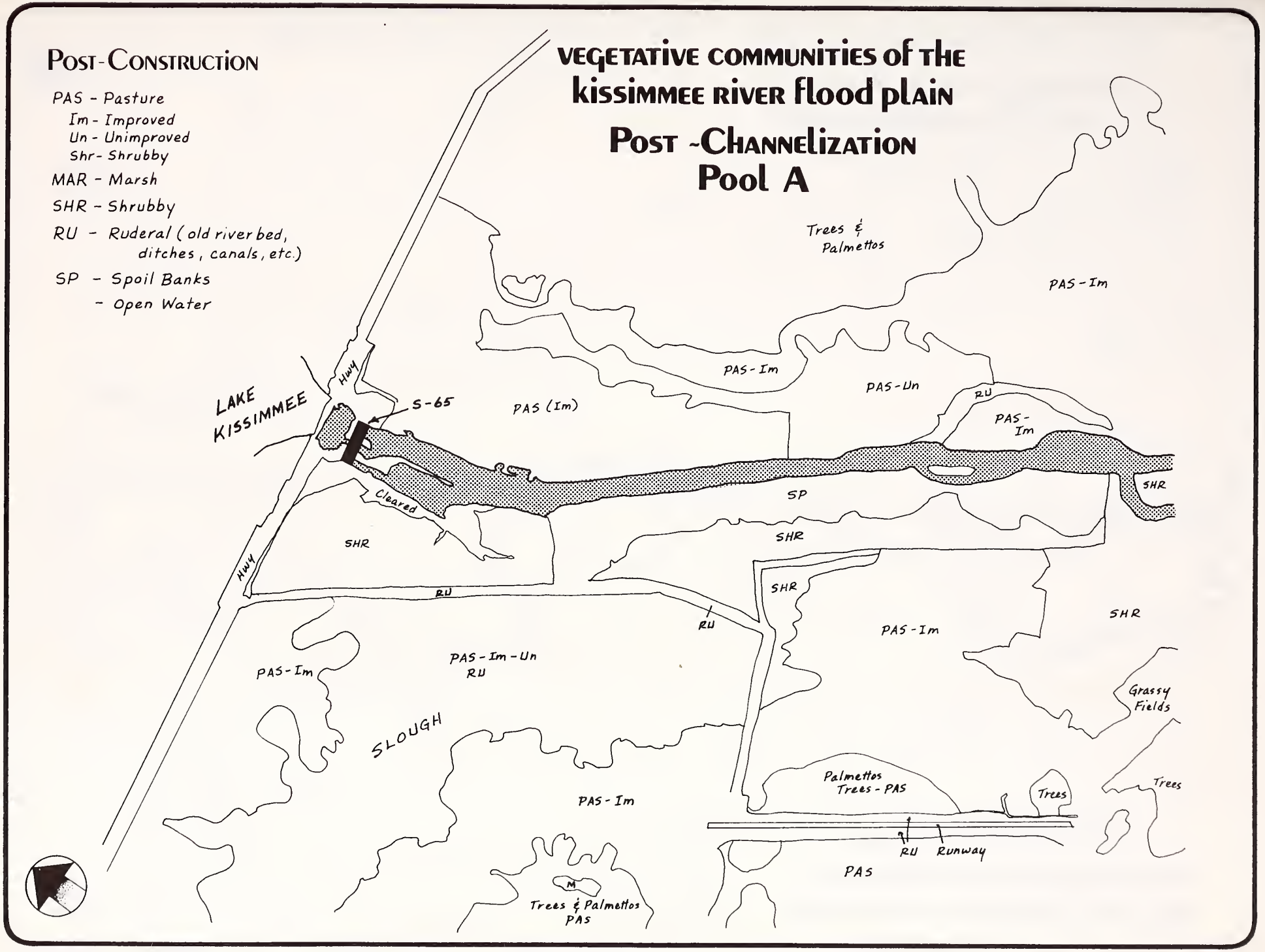

POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
VEGETATIVE COMMUNITIES of the kissimmee river flood plain
POST -CHANNELIZATION
Pool A
LAKE KISSIMMEE
HWY
S-65
PAS (Im)
Trees & Palmettos
PAS - Im
PAS - Un
RU
PAS - Im
SHR
SP
Cleared
SHR
HWY
RU
SHR
RU
SHR
PAS - Im
PAS - Im
PAS - Im - Un
RU
Grassy Fields
SLOUGH
Palmettos
Trees - PAS
Trees
Trees
PAS - Im
RU
Runway
PAS
M
Trees & Palmettos
PAS

FIGURE 2b

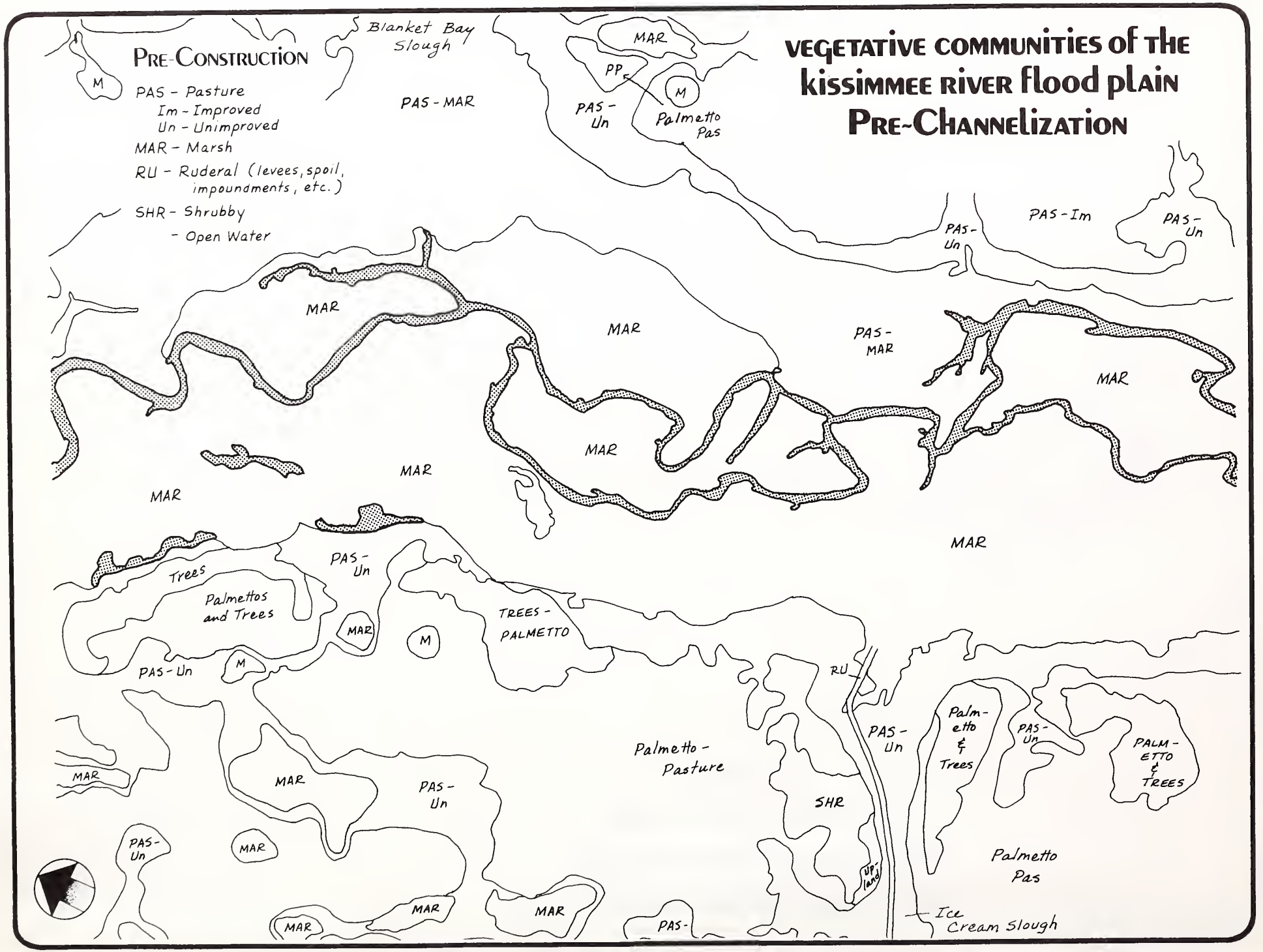

VEGETATIVE COMMUNITIES of the kissimmee RIVER flood plain
PRE-CHANNELIZATION
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
Blanket Bay Slough
PAS - MAR
MAR
PP
M
PAS - Un
Palmetto Pas
PAS - Im
PAS - Un
PAS - MAR
MAR
MAR
MAR
MAR
MAR
Trees
Palmettos and Trees
PAS - Un
MAR
M
PAS - Un
M
TREES - PALMETTO
MAR
MAR
PAS - Un
MAR
MAR
MAR
MAR
PAS -
Palmetto - Pasture
RU
SHR
UP-land
PAS - Un
Palm-etto & Trees
PAS - Un
PALM-ETTO & TREES
Palmetto Pas
Ice Cream Slough

FIGURE 3a

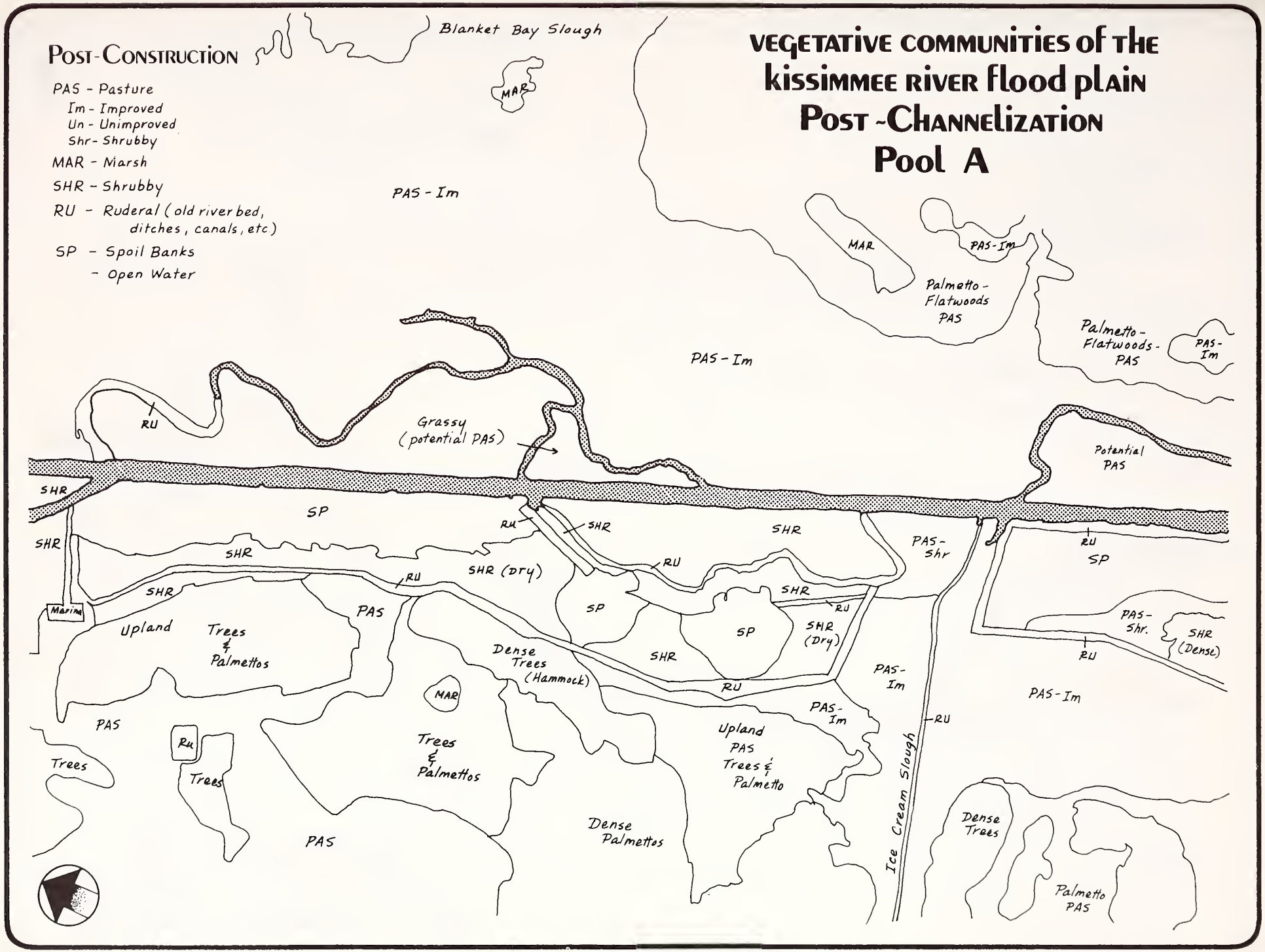

VEGETATIVE COMMUNITIES of the kissimmee river flood plain
POST-CHANNELIZATION
Pool A
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc)
SP - Spoil Banks
- Open Water
Blanket Bay Slough
MAR
PAS - Im
MAR
PAS-Im
Palmetto-Flatwoods PAS
Palmetto-Flatwoods-PAS
PAS-Im
PAS - Im
RU
Grassy (potential PAS)
Potential PAS
SHR
SP
SHR
SHR
RU
SHR
SHR
PAS-Shr
RU
SP
SHR
SHR (dry)
RU
SHR
Marina
PAS
SP
RU
PAS-Shr.
SHR (Dense)
Upland Trees & Palmettos
SP
SHR (Dry)
Dense Trees (Hammock)
SHR
RU
PAS-Im
PAS-Im
PAS - Im
MAR
PAS
PAS-Im
RU
Upland PAS Trees & Palmetto
Ice Cream Slough
Trees
Ru
Trees
Trees & Palmettos
PAS
Dense Palmettos
Dense Trees
Palmetto PAS

FIGURE 3b

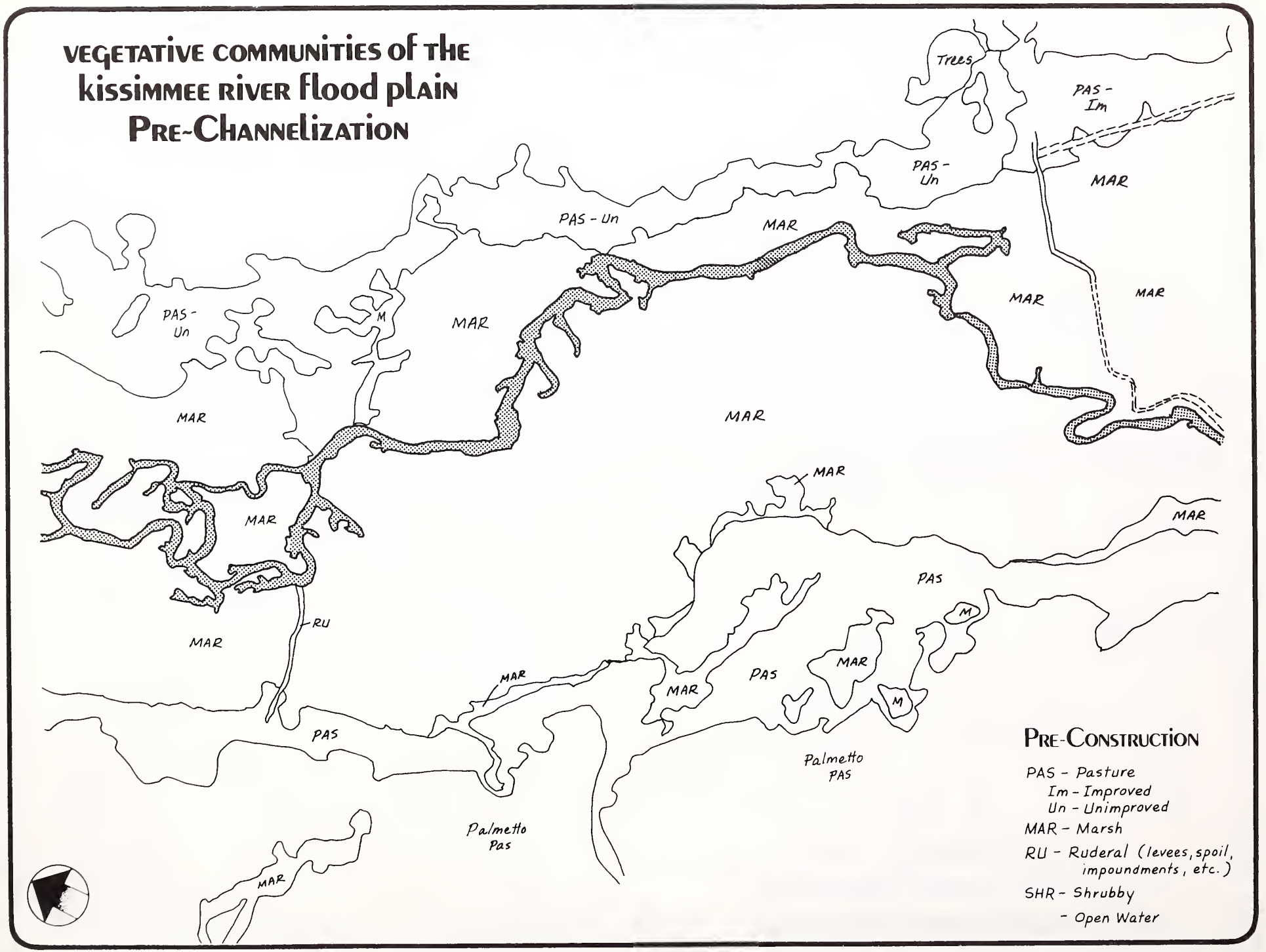

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
Trees
PAS - Im
PAS - Un
MAR
PAS - Un
MAR
PAS - Un
M
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
RU
MAR
MAR
PAS
MAR
MAR
PAS
MAR
M
M
PAS
Palmetto
PAS
Palmetto
Pas
MAR
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 4a

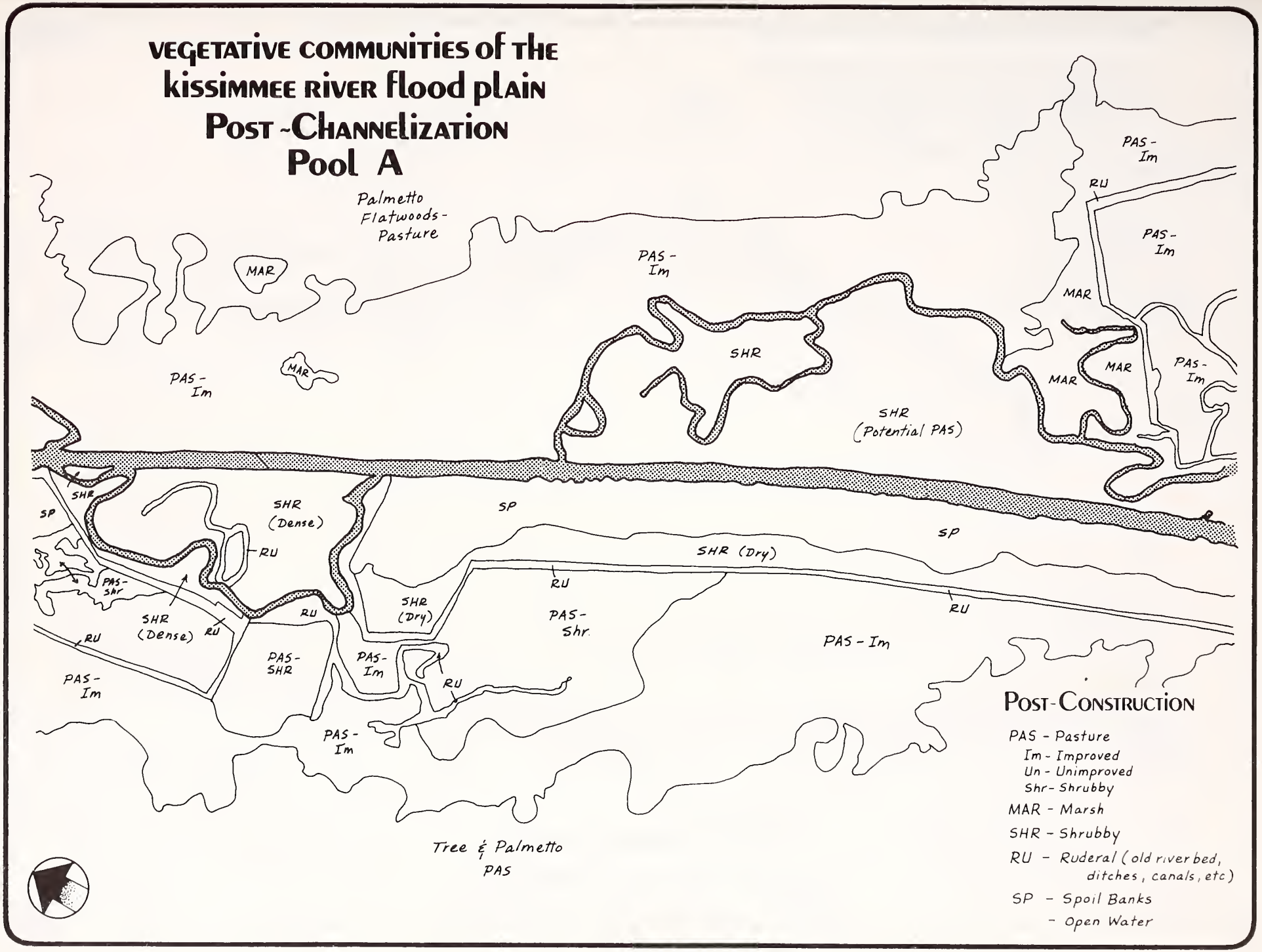

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
POST-CHANNELIZATION
Pool A
Palmetto Flatwoods-Pasture
PAS-Im
MAR
SHR
SHR (Potential PAS)
SHR (Dense)
SHR (Dry)
SP
RU
PAS-Shr
PAS-SHR
Tree & Palmetto PAS
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc)
SP - Spoil Banks
- Open Water

FIGURE 4b

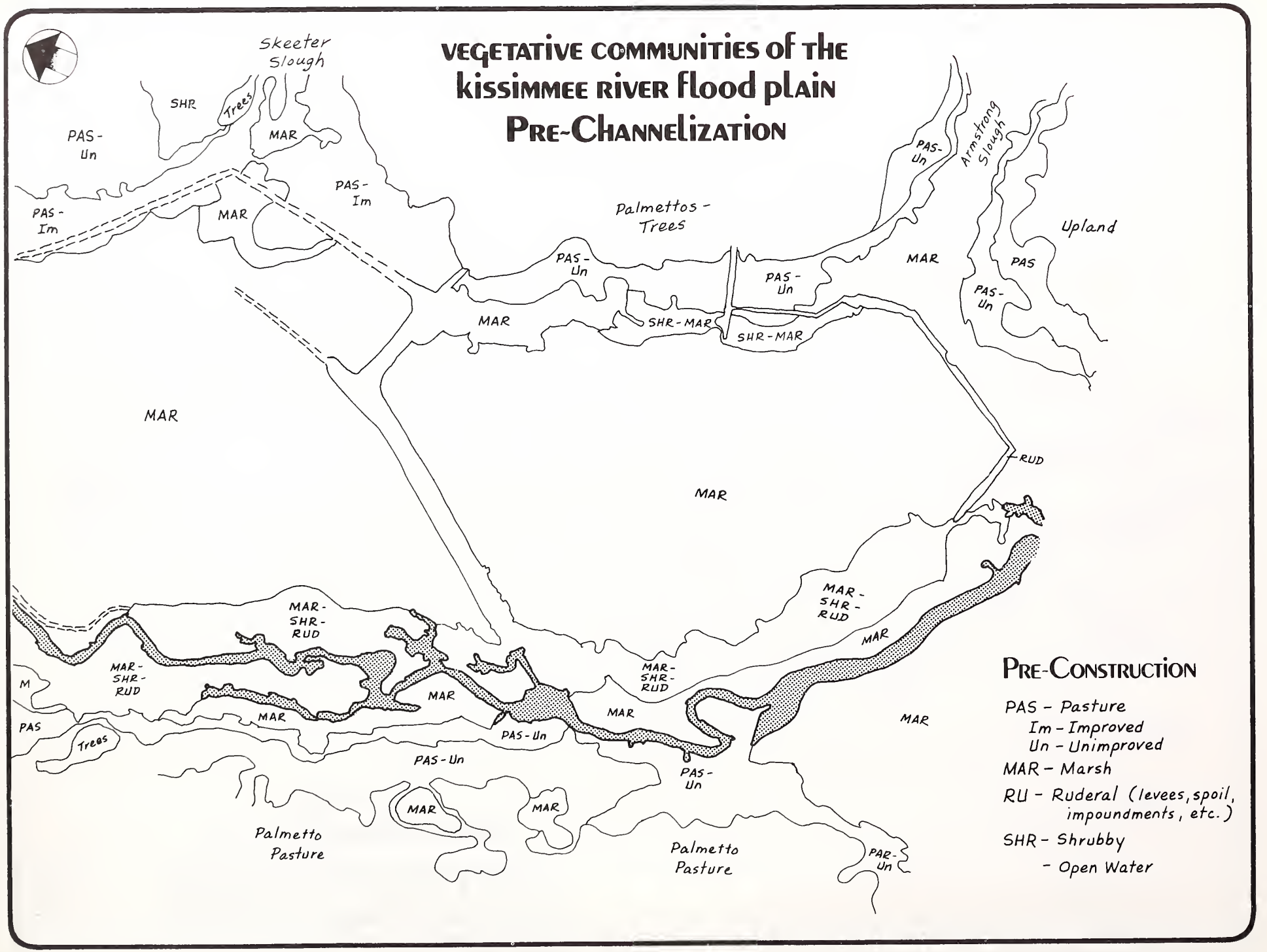

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
PRE-CHANNELIZATION
Skeeter Slough
Armstrong Slough
Upland
Palmettos - Trees
Palmetto Pasture
Palmetto Pasture
SHR
Trees
PAS - Un
PAS - Im
MAR
SHR - MAR
MAR - SHR - RUD
RUD
PAR - Un
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 5a

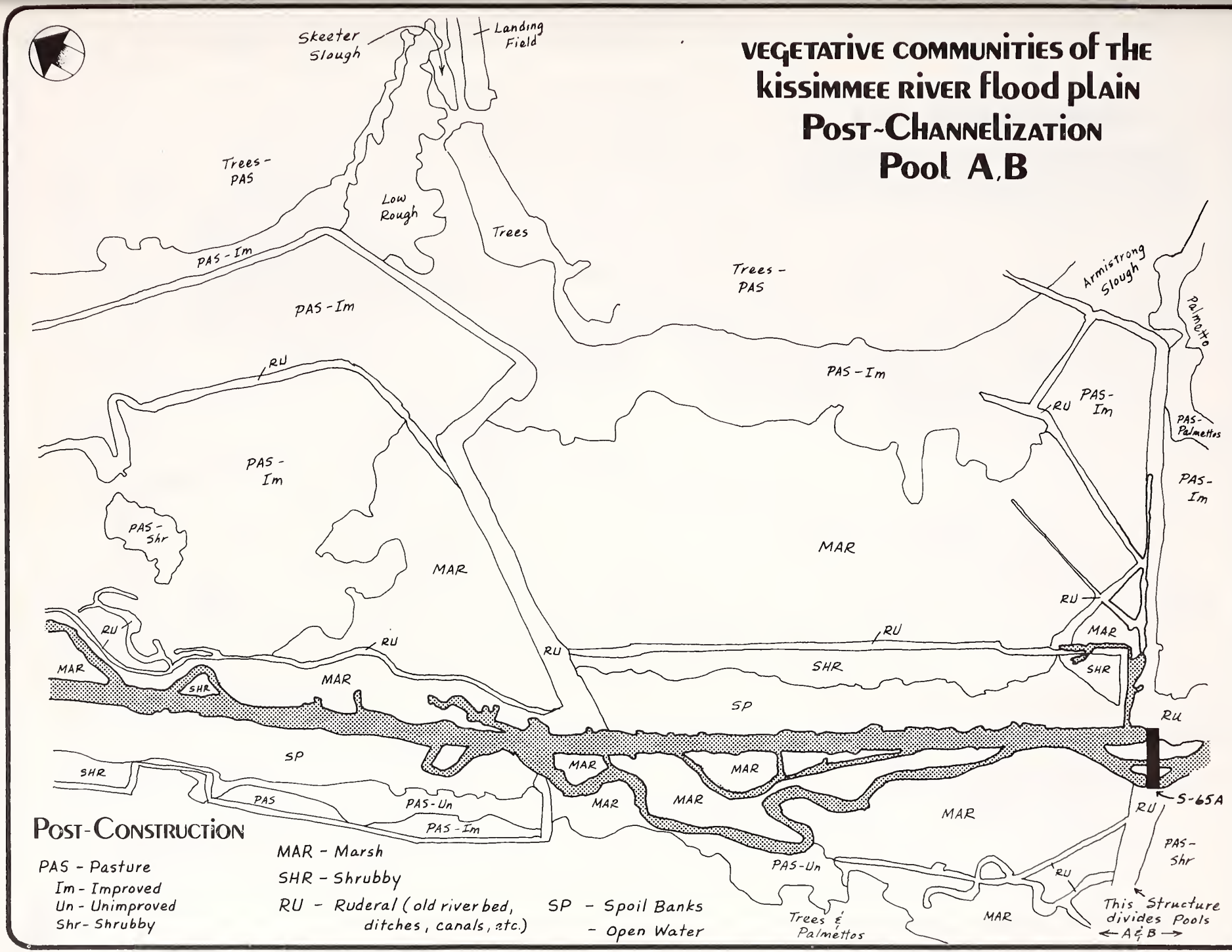

VEGETATIVE COMMUNITIES of the
kissimmee RIVER flood plain
POST-CHANNELIZATION
Pool A,B
Skeeter Slough
Landing Field
Trees - PAS
Low Rough
Trees
PAS - Im
PAS - Im
Trees - PAS
Armistrong Slough
Palmetto
RU
PAS - Im
RU
PAS - Im
PAS - Palmettos
PAS - Im
PAS - Shr
MAR
MAR
RU
RU
RU
RU
MAR
SHR
SHR
MAR
MAR
SHR
SP
RU
SP
SHR
PAS
PAS-Un
PAS - Im
MAR
MAR
MAR
MAR
MAR
S-65A
RU
PAS - Shr
RU
PAS-Un
Trees & Palmettos
MAR
This Structure divides Pools A & B
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 5b

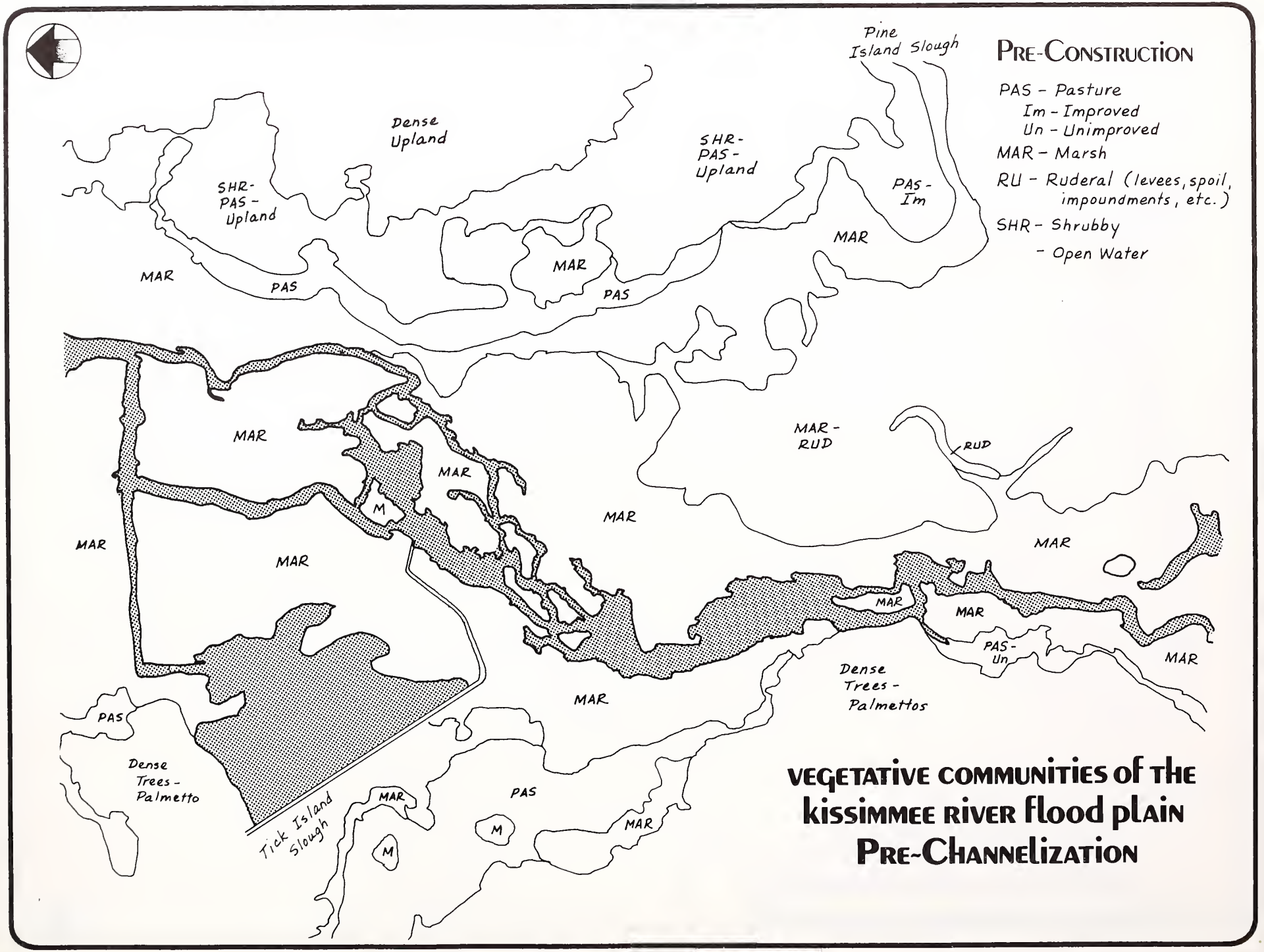

Pine Island Slough
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
Dense Upland
SHR-PAS-Upland
SHR-PAS-Upland
PAS-Im
MAR
MAR
PAS
MAR
PAS
MAR
MAR-RUD
RUD
MAR
M
MAR
MAR
MAR
MAR
MAR
MAR
PAS-Un
MAR
Dense Trees-Palmettos
MAR
PAS
Dense Trees-Palmetto
Tick Island Slough
MAR
PAS
M
M
MAR
VEGETATIVE COMMUNITIES of the kissimmee river flood plain
PRE-CHANNELIZATION

FIGURE 6a

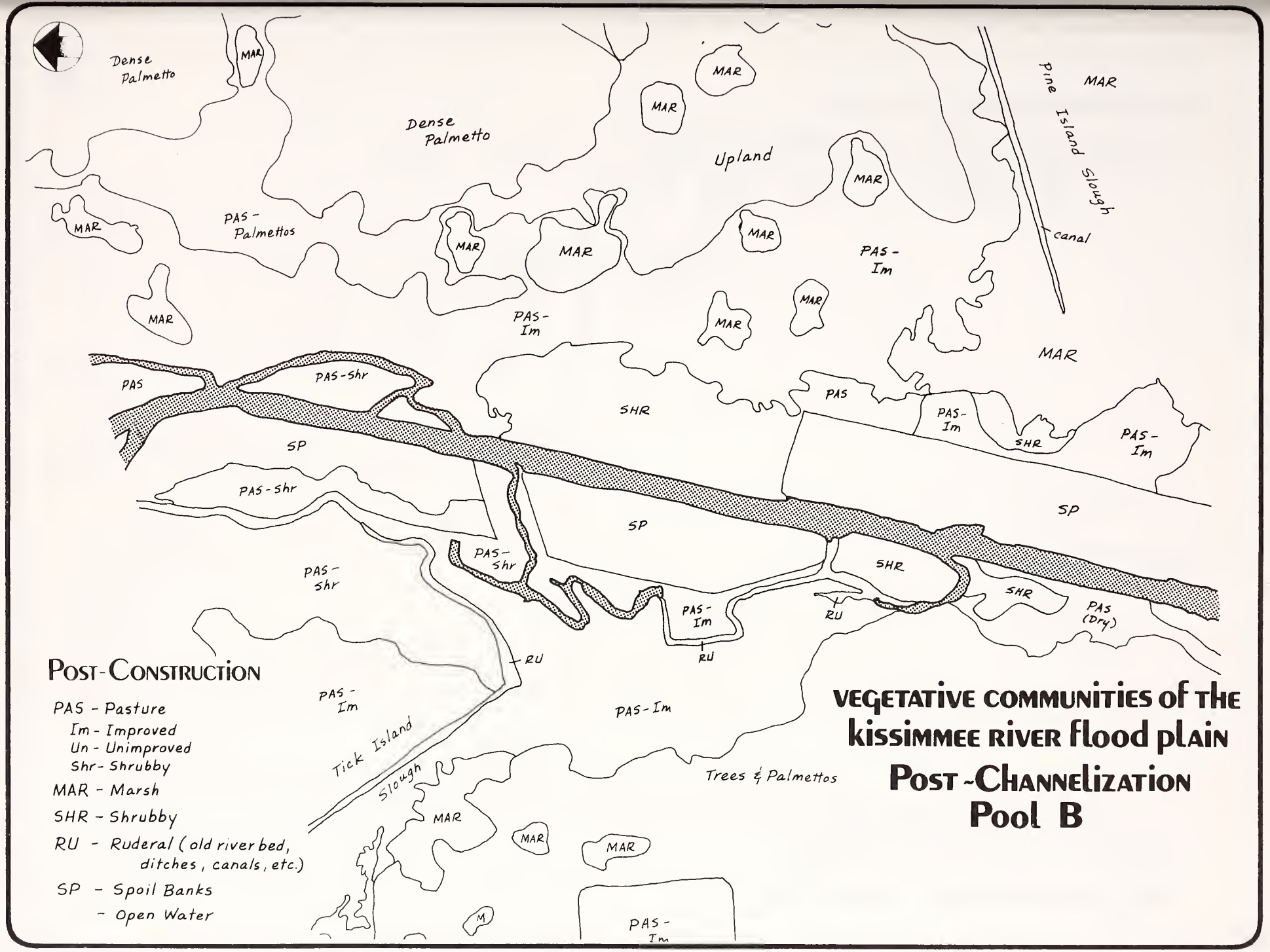

Dense Palmetto
MAR
Dense Palmetto
Upland
Pine Island Slough
canal
PAS - Palmettos
PAS - Im
PAS
PAS-shr
SHR
SP
PAS-shr
PAS-Shr
PAS-Shr
RU
PAS (Dry)
Tick Island Slough
Trees & Palmettos
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
VEGETATIVE COMMUNITIES of the kissimmee RIVER flood plain
POST-CHANNELIZATION
Pool B

FIGURE 6b

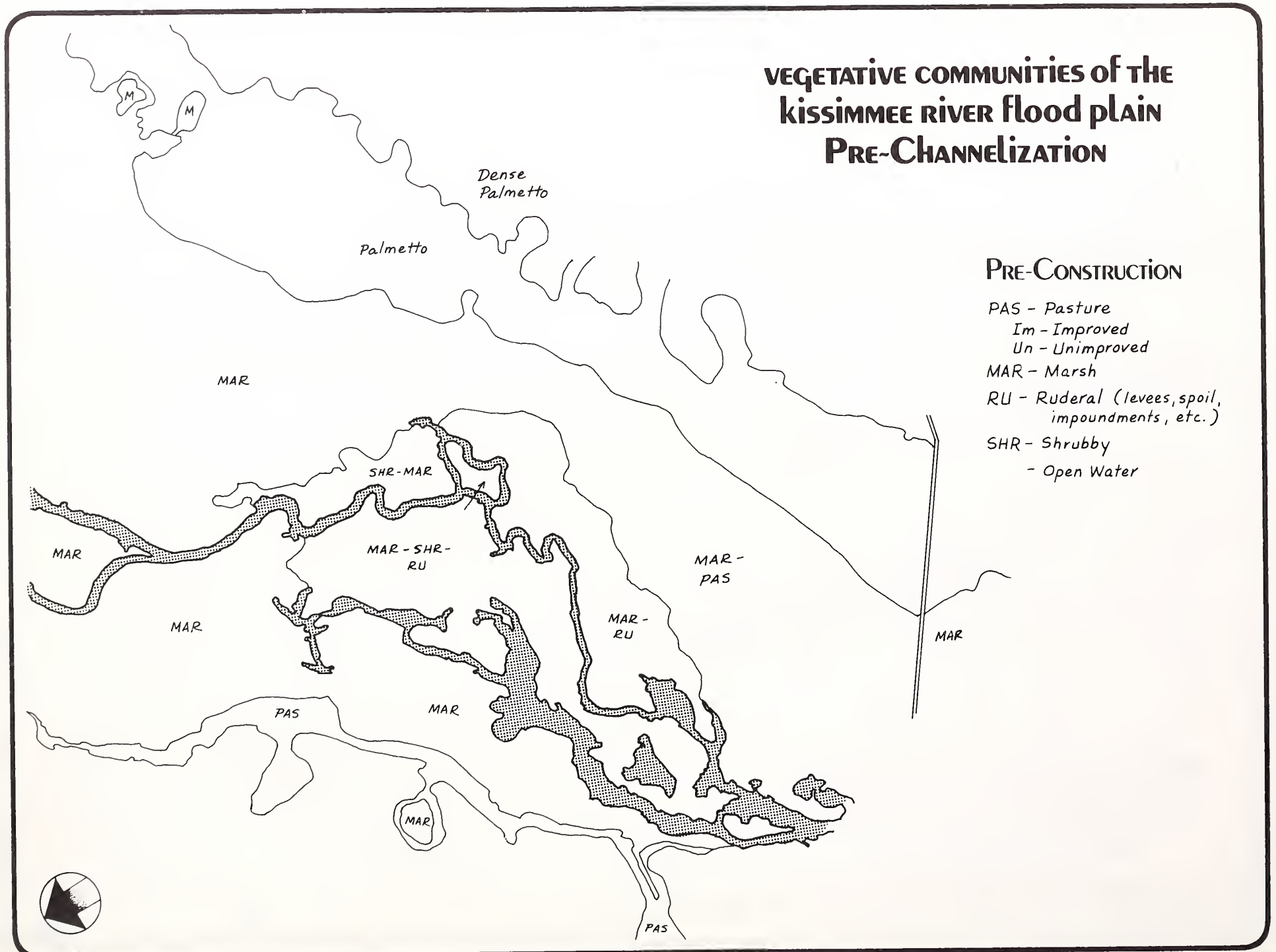

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
PRE-CHANNELIZATION
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
M
M
Dense Palmetto
Palmetto
MAR
SHR-MAR
MAR
MAR-SHR-RU
MAR-PAS
MAR
MAR-RU
MAR
PAS
MAR
MAR
PAS

FIGURE 7a

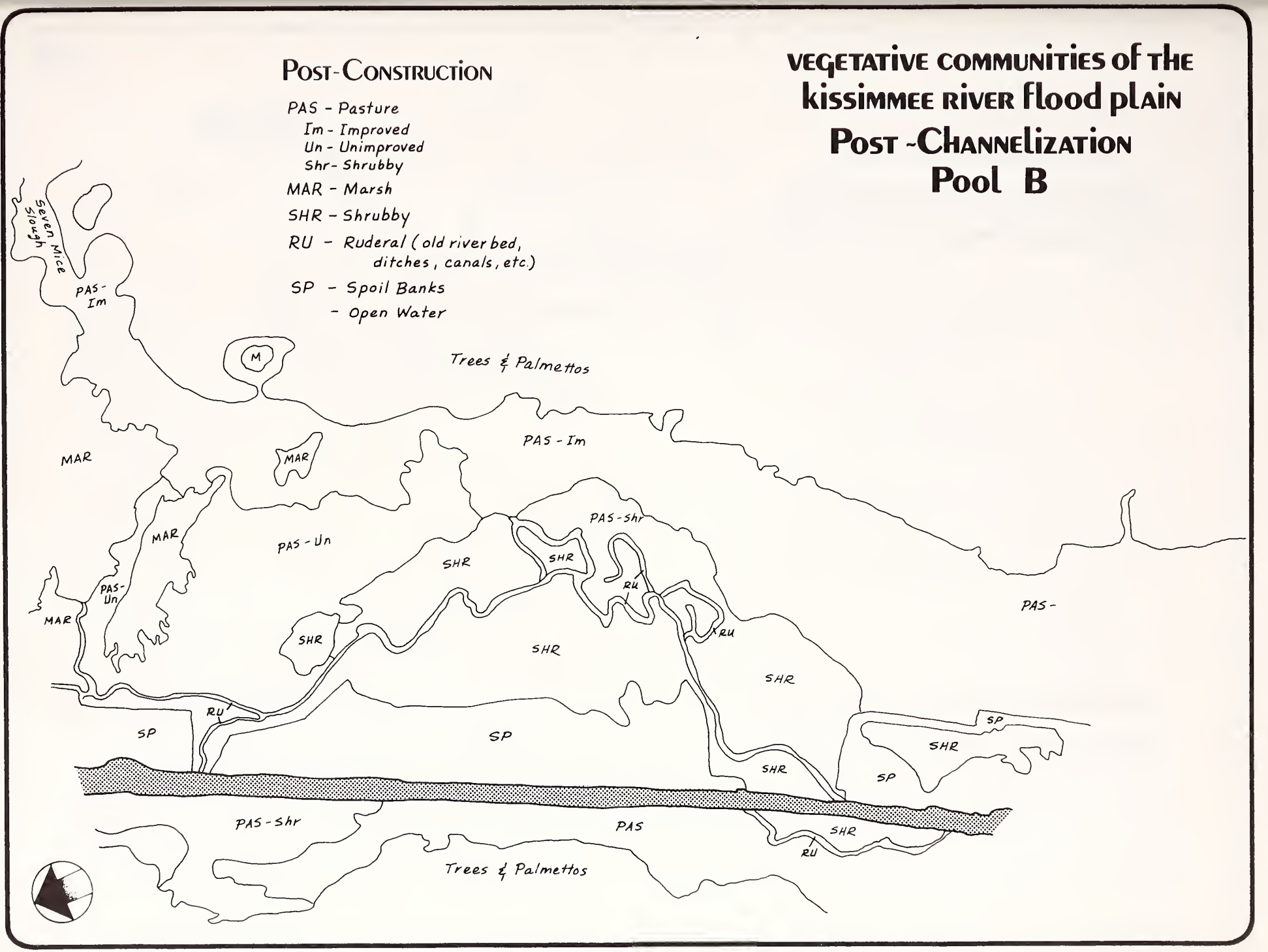
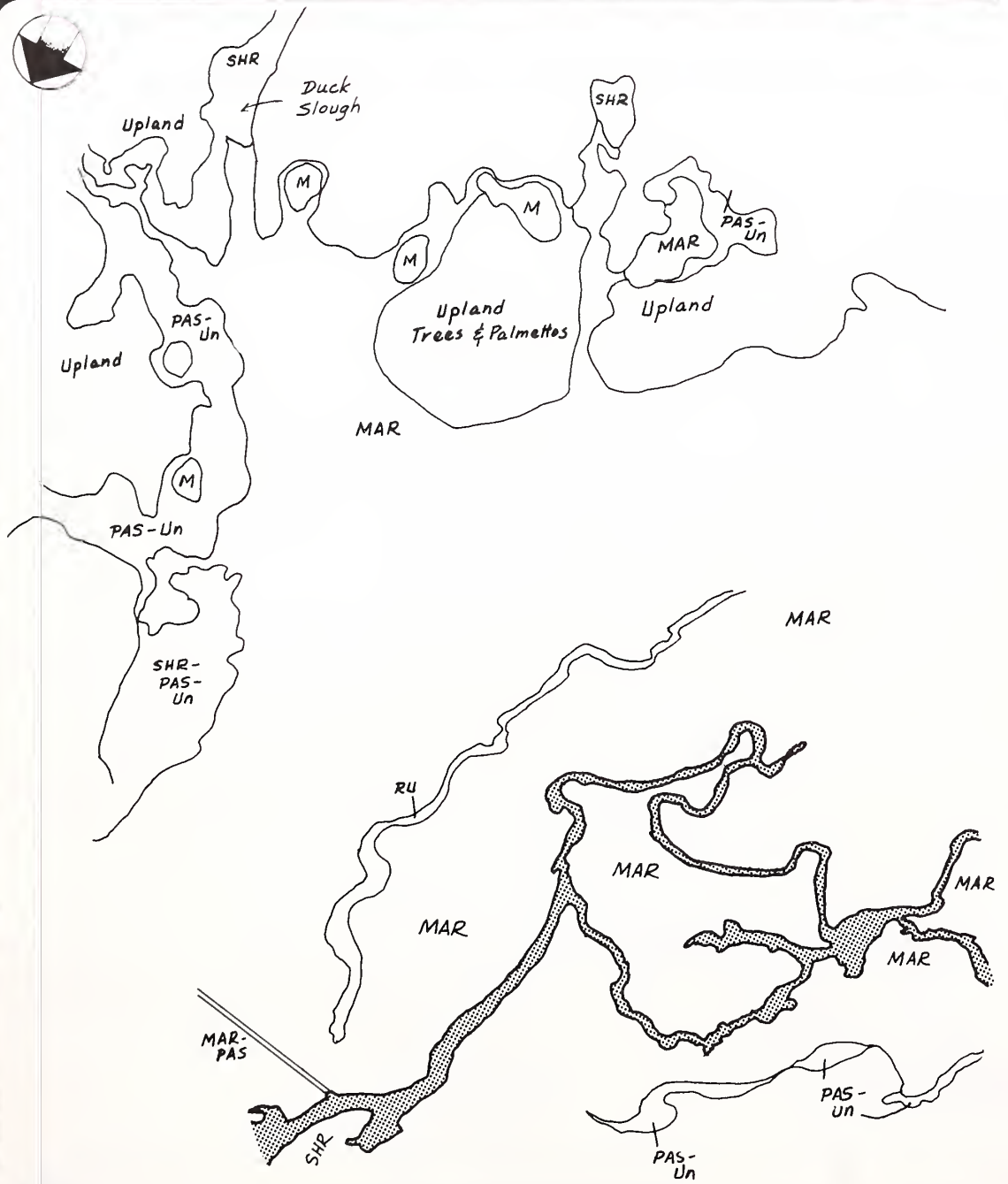

VEGETATIVE COMMUNITIES of the kissimmee river flood plain
POST-CHANNELIZATION
Pool B
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
Seven Mile Slough
PAS-Im
M
Trees & Palmettos
PAS - Im
MAR
MAR
MAR
MAR
PAS-Un
PAS-Un
PAS-Shr
SHR
SHR
SHR
SHR
SHR
SHR
RU
RU
RU
RU
PAS-
SP
SP
SP
SP
SHR
SHR
PAS-Shr
PAS
SHR
Trees & Palmettos

FIGURE 7b

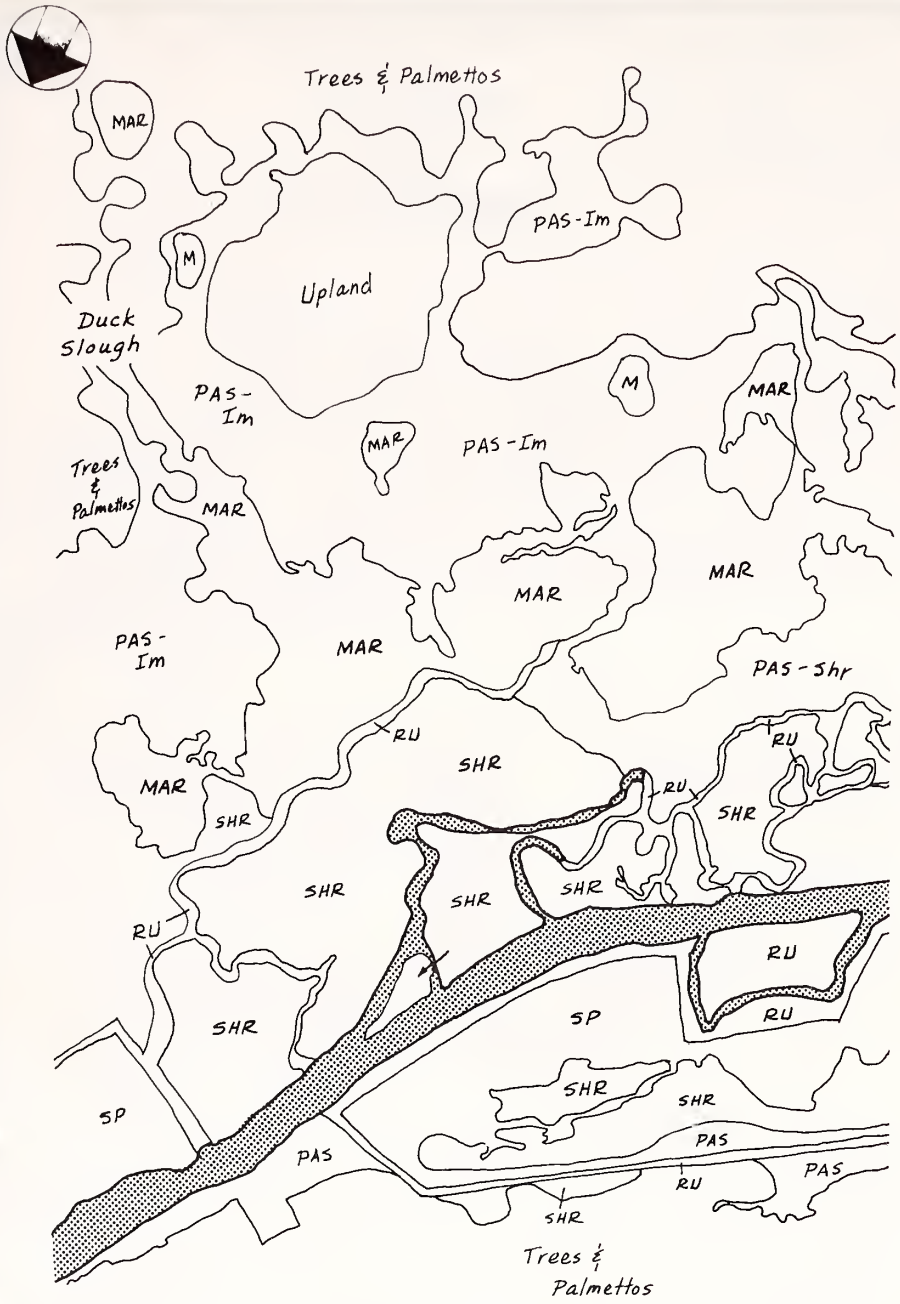


PRE-CONSTRUCTION

PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

VEGETATIVE COMMUNITIES OF THE KISSIMMEE RIVER FLOOD PLAIN PRE-CHANNELIZATION

FIGURE 8a



POST-CONSTRUCTION

PAS - Pasture
- Im - Improved
- Un - Unimproved
- Shr - Shrubby

MAR - Marsh

SHR - Shrubby

RU - Ruderal (old river bed, ditches, canals, etc.)

SP - Spoil Banks

- Open Water

VEGETATIVE COMMUNITIES OF THE KISSIMMEE RIVER FLOOD PLAIN

POST-CHANNELIZATION

Pool B

FIGURE 8b

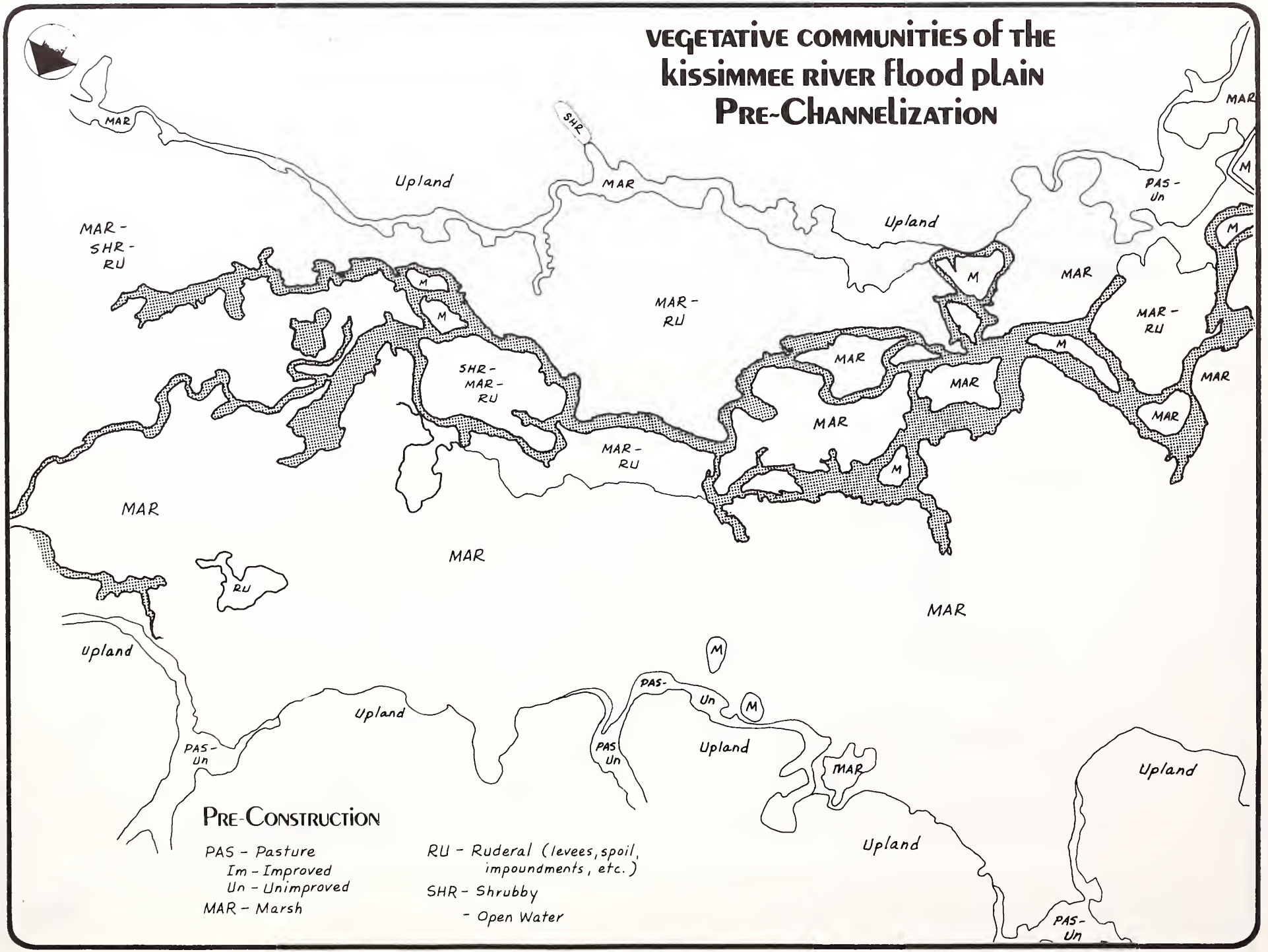

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
MAR
SHR
Upland
MAR
Upland
PAS - Un
M
MAR - SHR - RU
MAR - RU
MAR
SHR - MAR - RU
MAR - RU
MAR
MAR
MAR
MAR
MAR
RU
MAR
MAR
Upland
Upland
PAS - Un
PAS - Un
M
PAS - Un
Upland
MAR
Upland
Upland
PAS - Un
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 9a

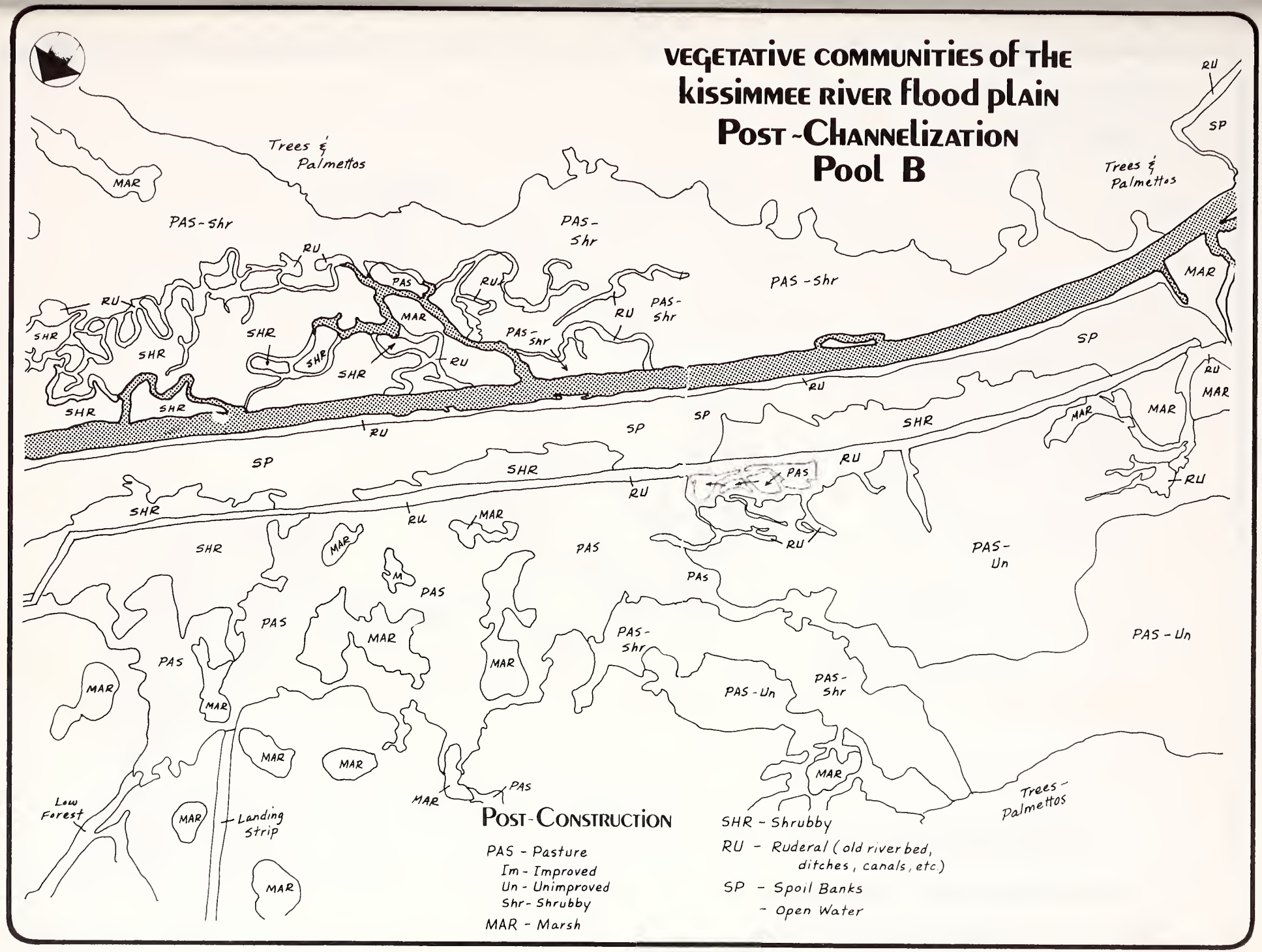
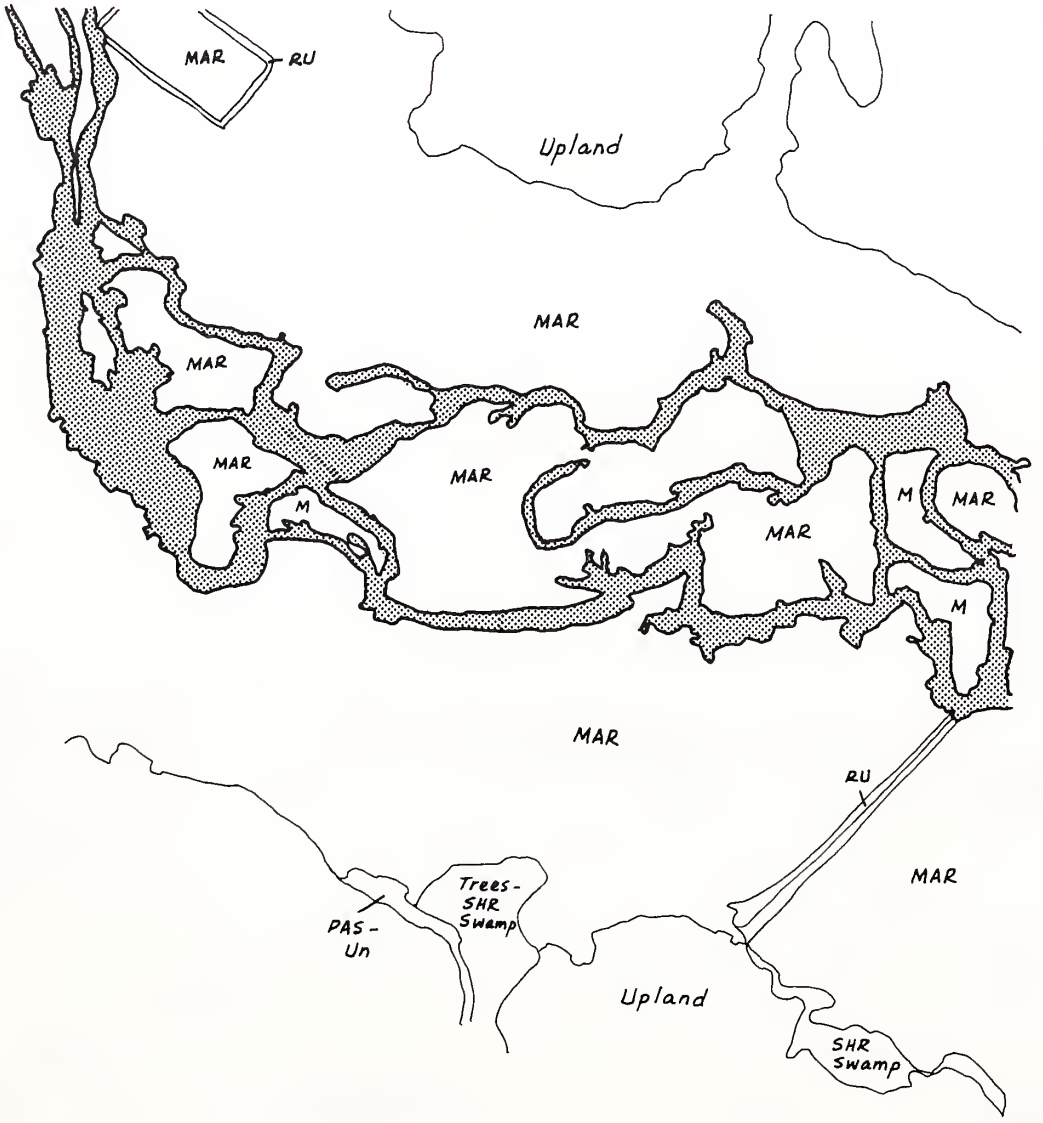

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
POST-CHANNELIZATION
Pool B
Trees & Palmettos
PAS-Shr
MAR
RU
SHR
SP
PAS
PAS-Un
Low Forest
Landing Strip
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 9b

VEGETATIVE COMMUNITIES OF THE kissimmee river flood plain

PRE-CHANNELIZATION



PRE-CONSTRUCTION

PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 10a

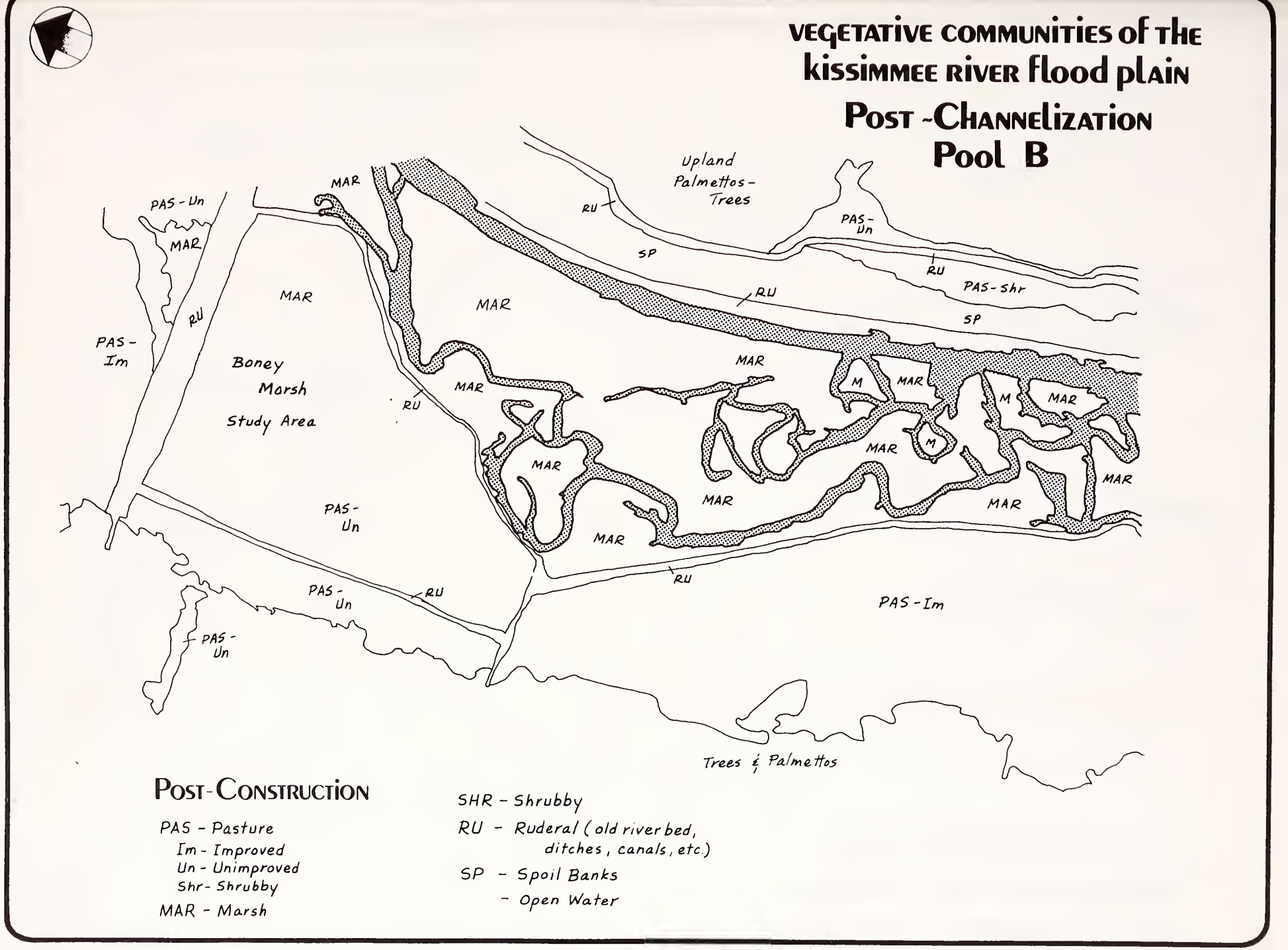

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
Post -Channelization
Pool B
Upland
Palmettos -
Trees
PAS - Un
MAR
RU
SP
PAS-
Un
PAS-Shr
PAS -
Im
Boney
Marsh
Study Area
M
PAS -
Un
PAS - Im
Trees & Palmettos
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed,
ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 10b

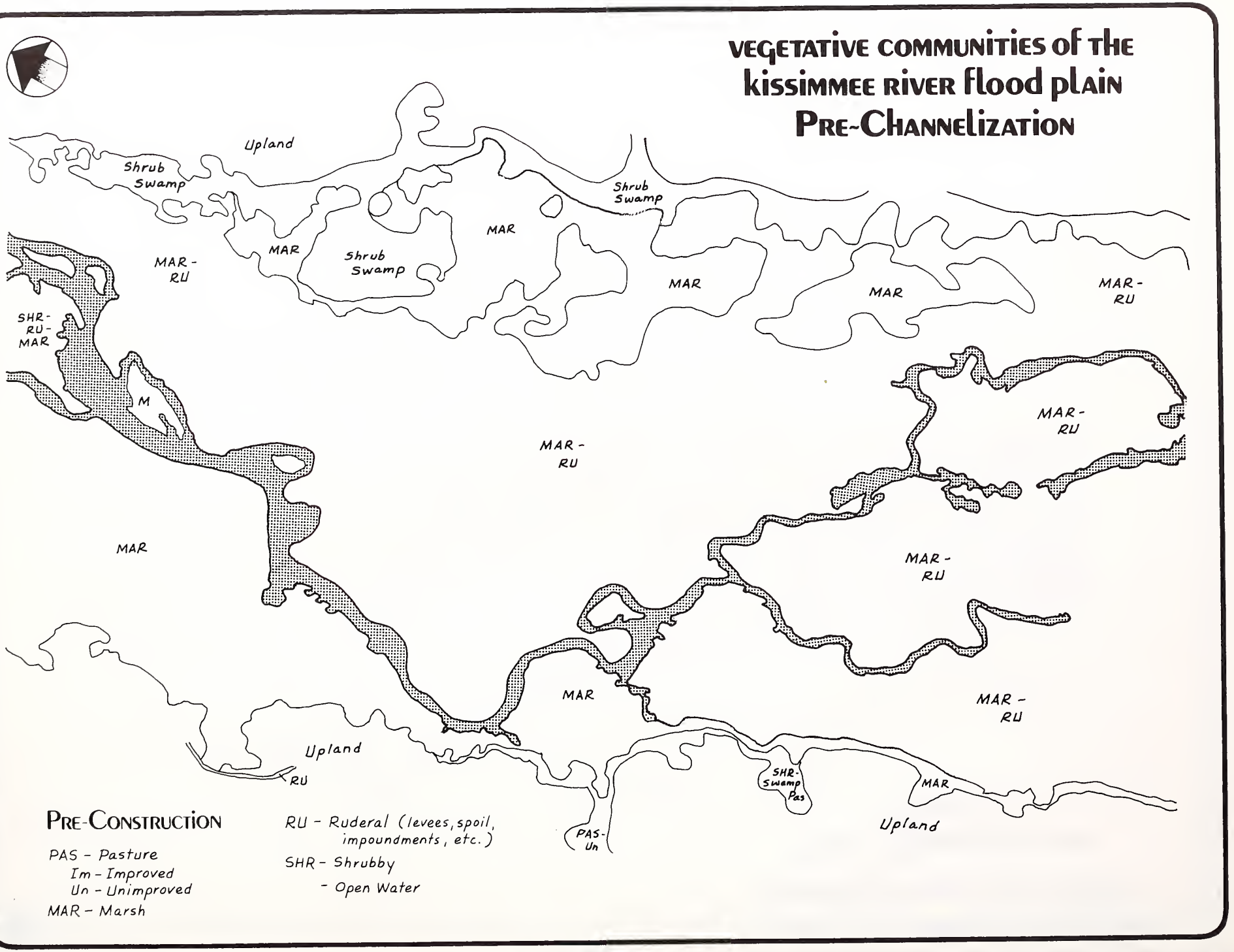

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
Upland
Shrub Swamp
Shrub Swamp
MAR
MAR
Shrub Swamp
MAR
MAR
MAR-RU
MAR-RU
SHR-RU-MAR
M
MAR-RU
MAR-RU
MAR
MAR-RU
MAR
MAR-RU
Upland
RU
SHR-Swamp Pas
MAR
Upland
PAS-Un
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 11a

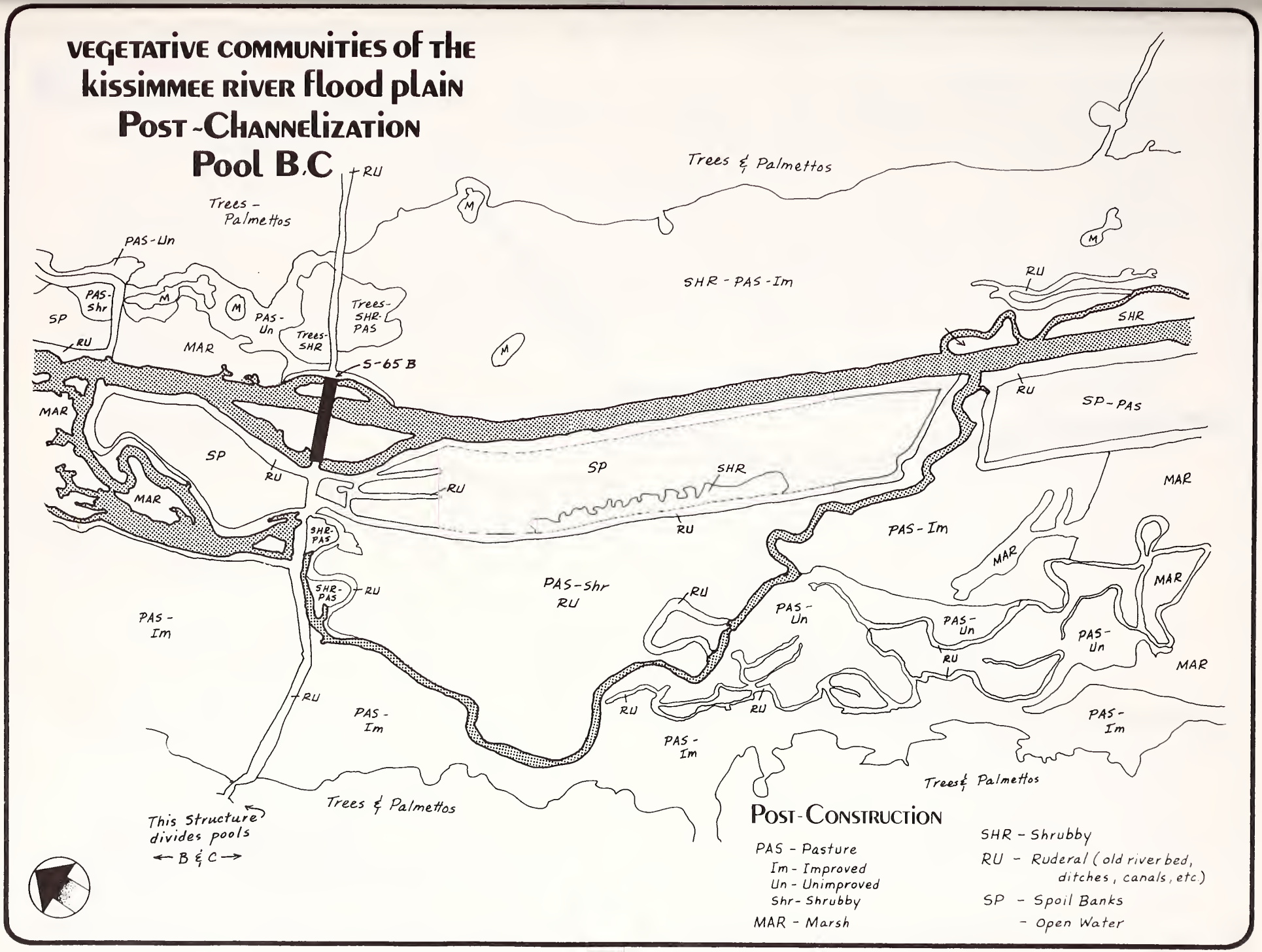

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
POST-CHANNELIZATION
Pool B,C
Trees & Palmettos
Trees - Palmettos
PAS-Un
PAS-shr
SP
RU
M
MAR
PAS-Un
Trees-SHR-PAS
Trees-SHR
S-65 B
SHR - PAS - Im
SHR
SP - PAS
SP
SHR
MAR
SHR-PAS
PAS-shr
RU
PAS-Im
PAS-Un
This Structure divides pools ← B & C →
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 11b

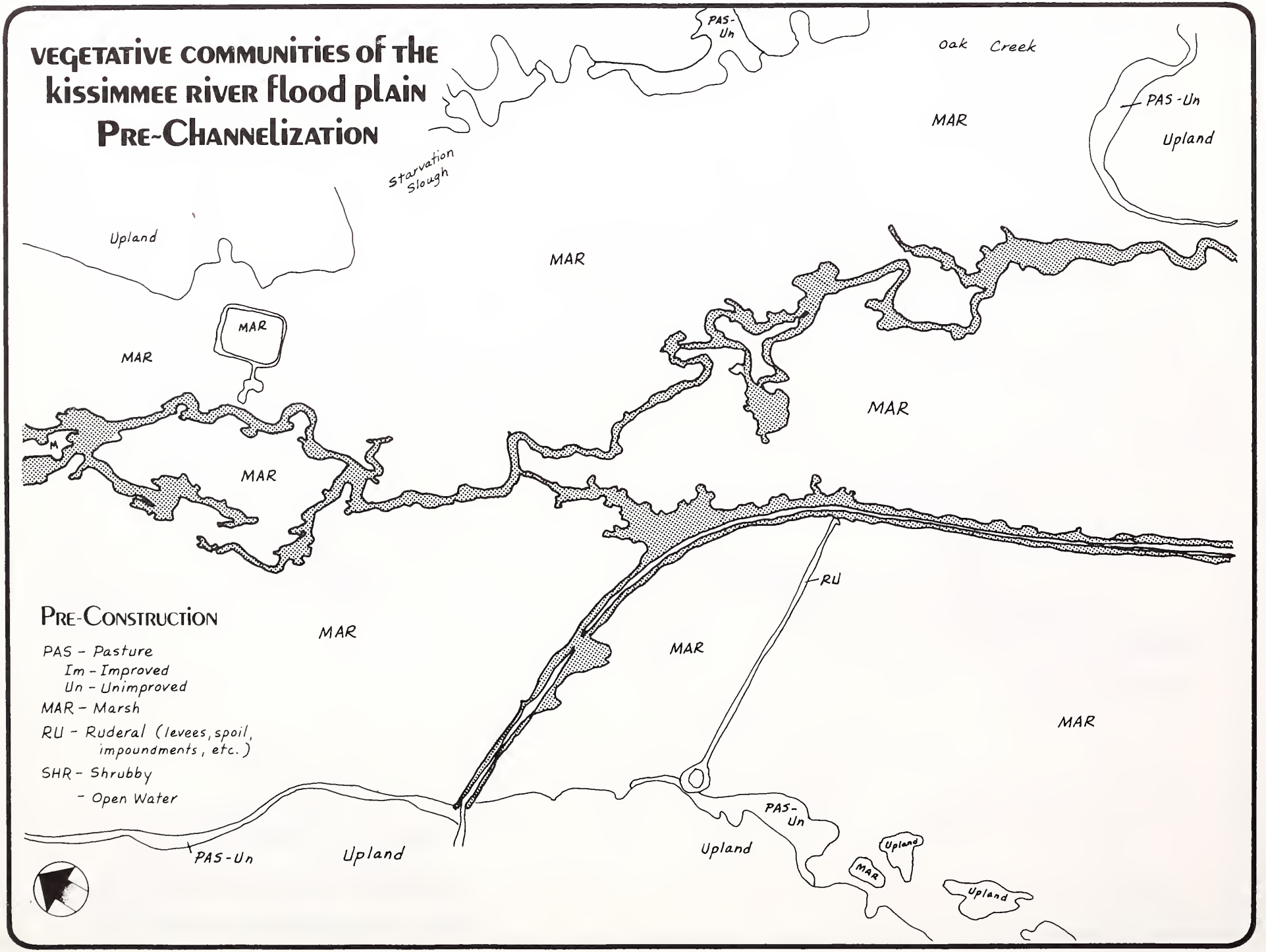

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
PRE-CHANNELIZATION
PAS-Un
Oak Creek
PAS-Un
Upland
MAR
Starvation Slough
Upland
MAR
MAR
MAR
MAR
MAR
RU
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
MAR
MAR
MAR
PAS-Un
Upland
Upland
PAS-Un
Upland
MAR
Upland

FIGURE 12a

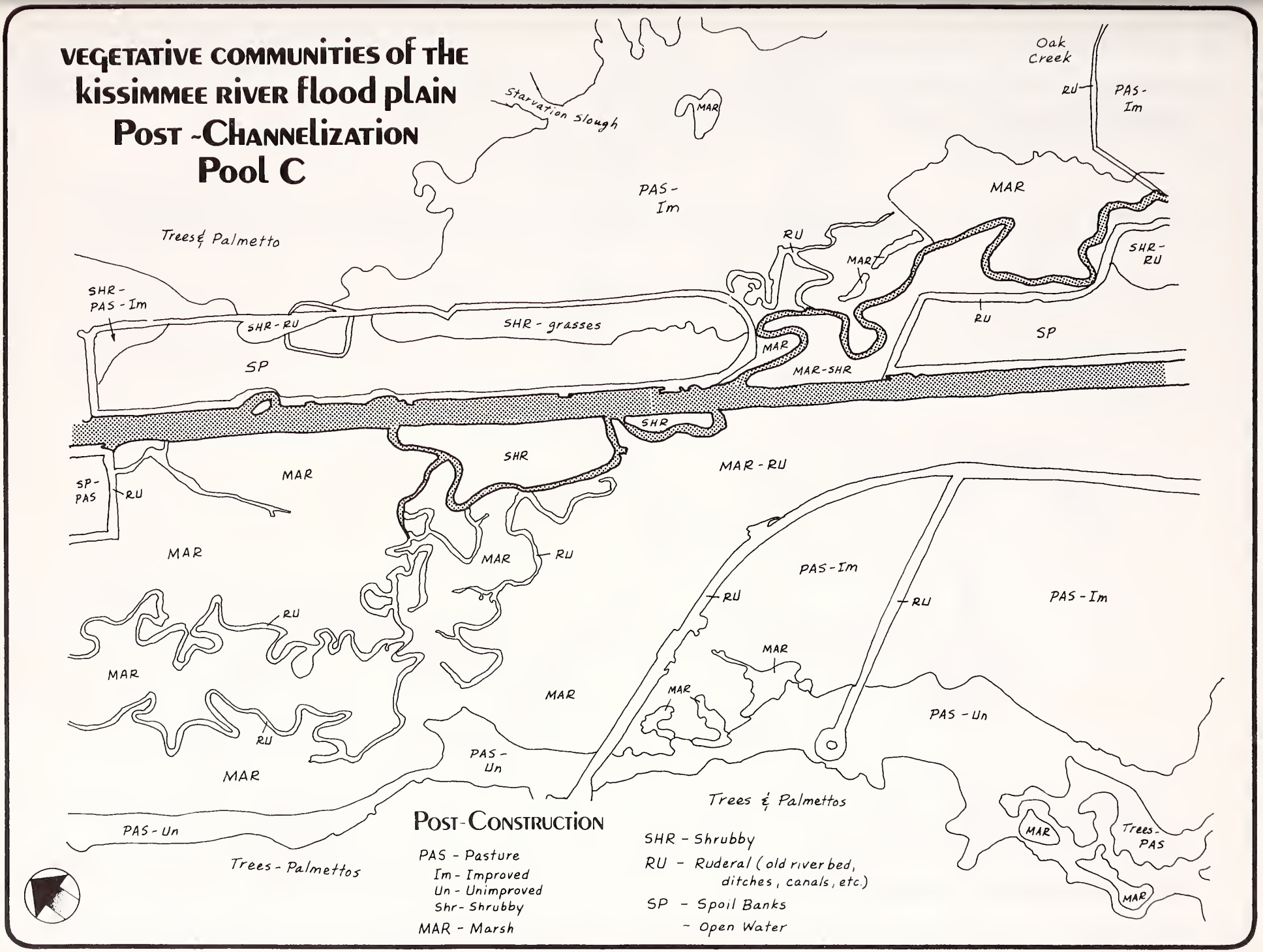

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
Post -Channelization
Pool C
Starvation Slough
MAR
Oak Creek
RU
PAS - Im
PAS - Im
MAR
Trees & Palmetto
RU
MAR
SHR - RU
SHR - PAS - Im
SHR - RU
SHR - grasses
SP
RU
SP
MAR
MAR-SHR
SHR
SHR
MAR - RU
SP - PAS
RU
MAR
MAR
MAR
RU
PAS - Im
RU
RU
PAS - Im
RU
MAR
MAR
MAR
MAR
PAS - Un
PAS - Un
MAR
Trees & Palmettos
PAS - Un
Trees - Palmettos
MAR
Trees - PAS
MAR
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 12b

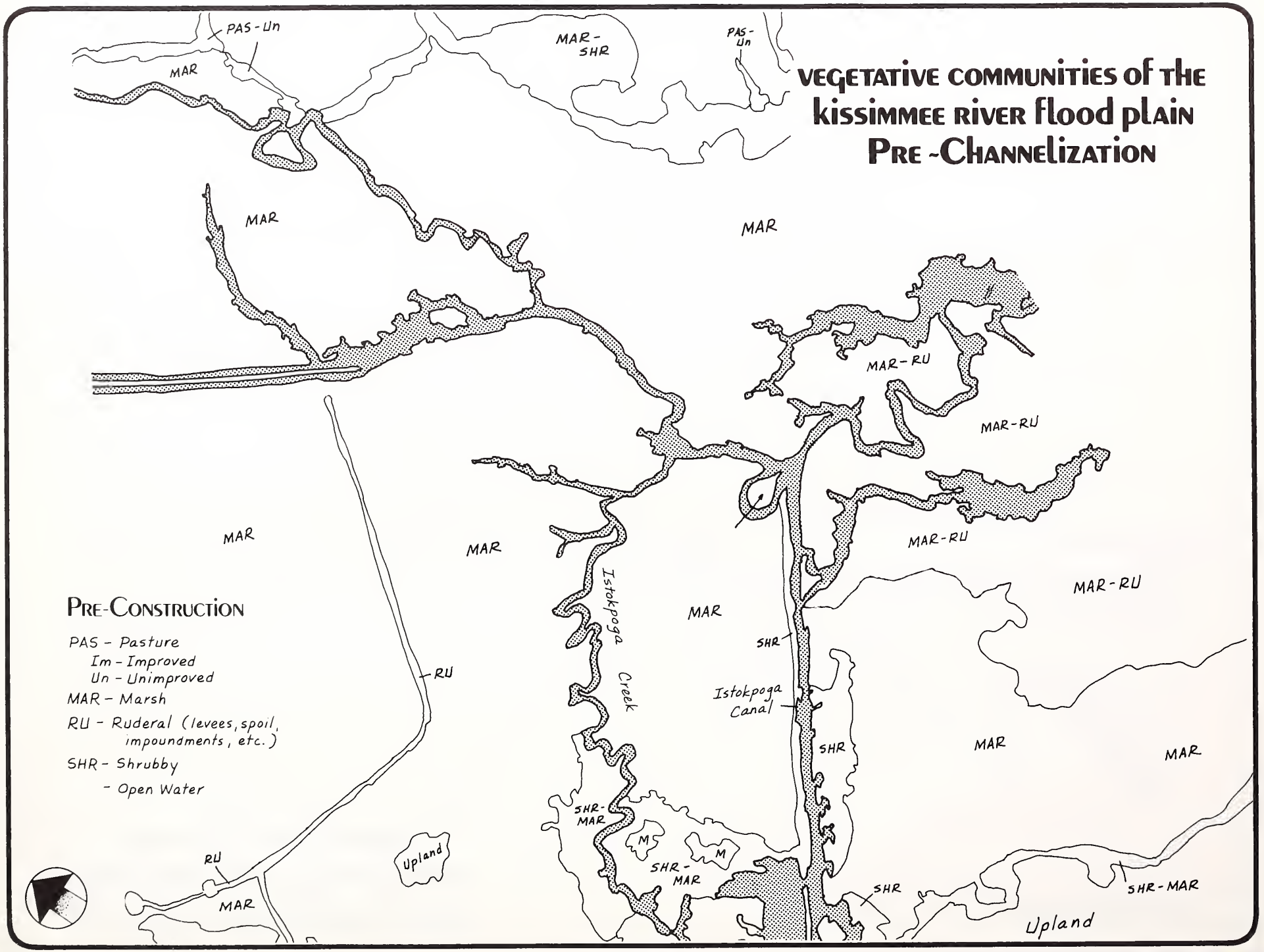

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
PAS-Un
MAR-SHR
MAR
MAR-RU
SHR
SHR-MAR
M
Istokpoga Creek
Istokpoga Canal
Upland

FIGURE 13a

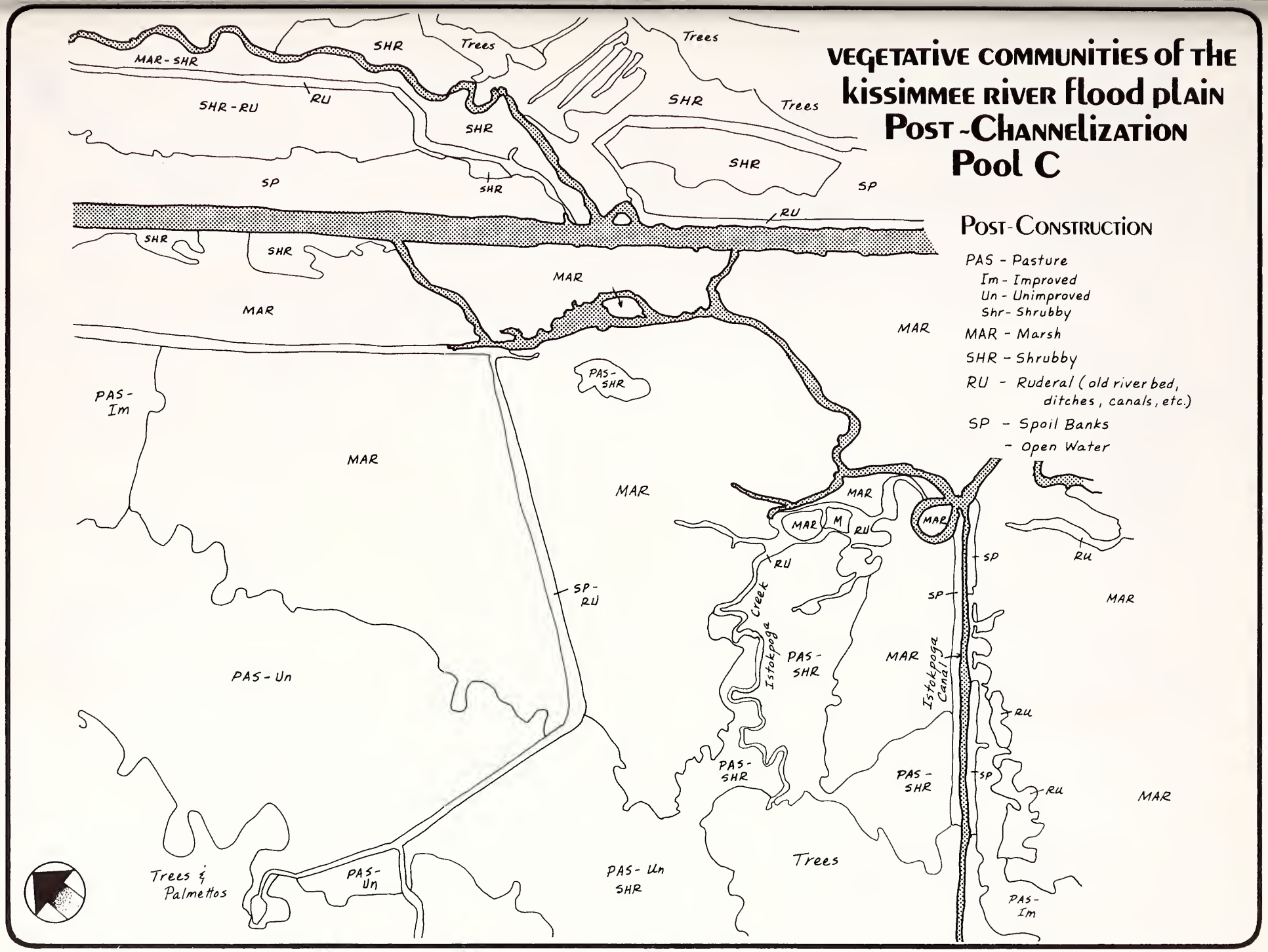

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
Post-Channelization
Pool C
Post-Construction
PAS - Pasture
Im - Improved
Un - Unimproved
Shr- Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
MAR-SHR
SHR-RU
RU
SHR
Trees
SP
MAR
PAS-Im
PAS-SHR
SP-RU
PAS-Un
Istokpoga Creek
Istokpoga Canal
M
Trees & Palmettos
PAS-Un SHR

FIGURE 13b

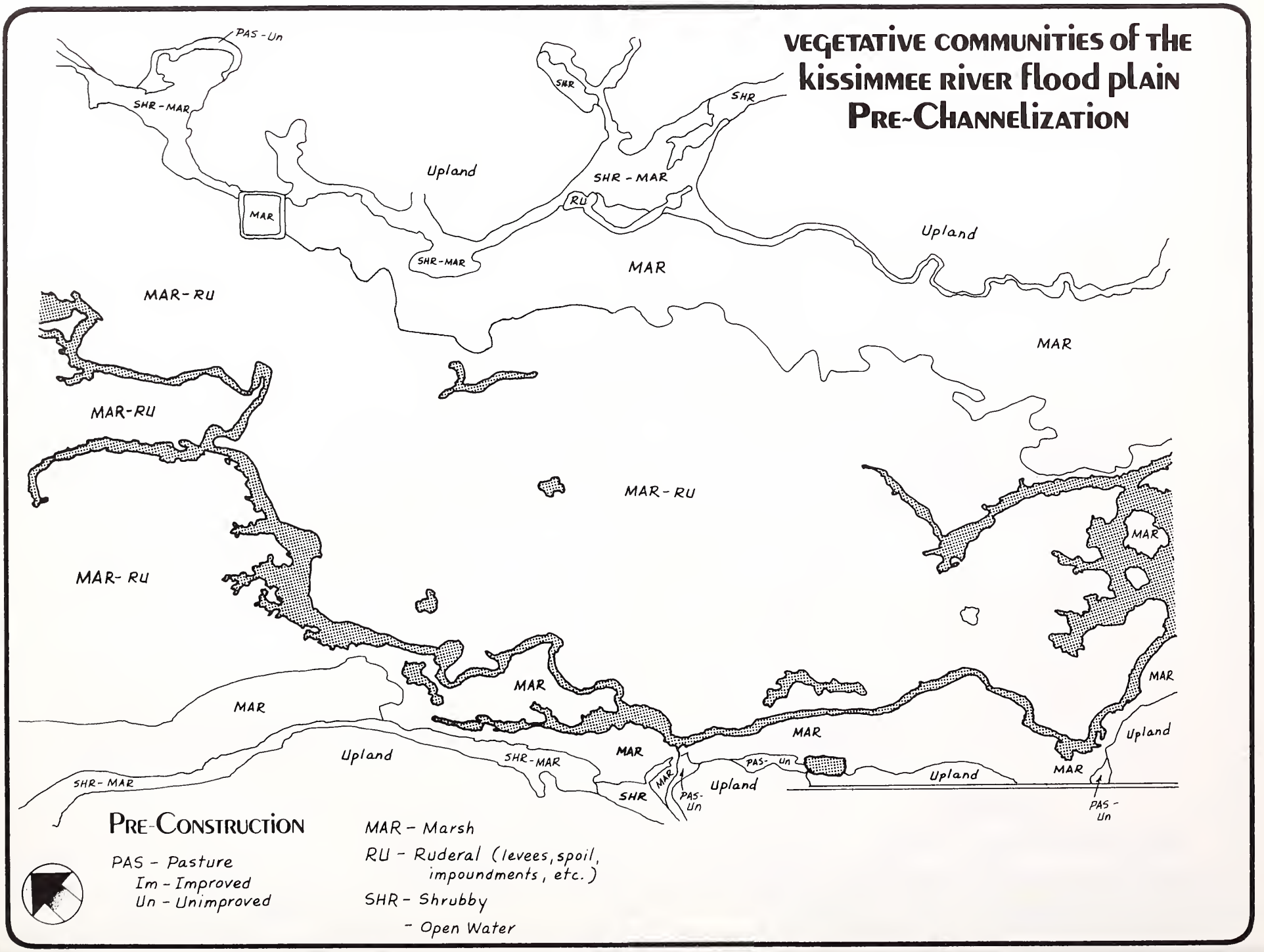

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
PAS - Un
SHR - MAR
SHR
SHR
Upland
MAR
RU
SHR - MAR
Upland
SHR-MAR
MAR
MAR - RU
MAR
MAR-RU
MAR-RU
MAR - RU
MAR
MAR
MAR
MAR
MAR
Upland
Upland
SHR-MAR
SHR - MAR
MAR
SHR
MAR
PAS - Un
Upland
PAS - Un
Upland
MAR
Upland
PAS - Un
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

FIGURE 14-

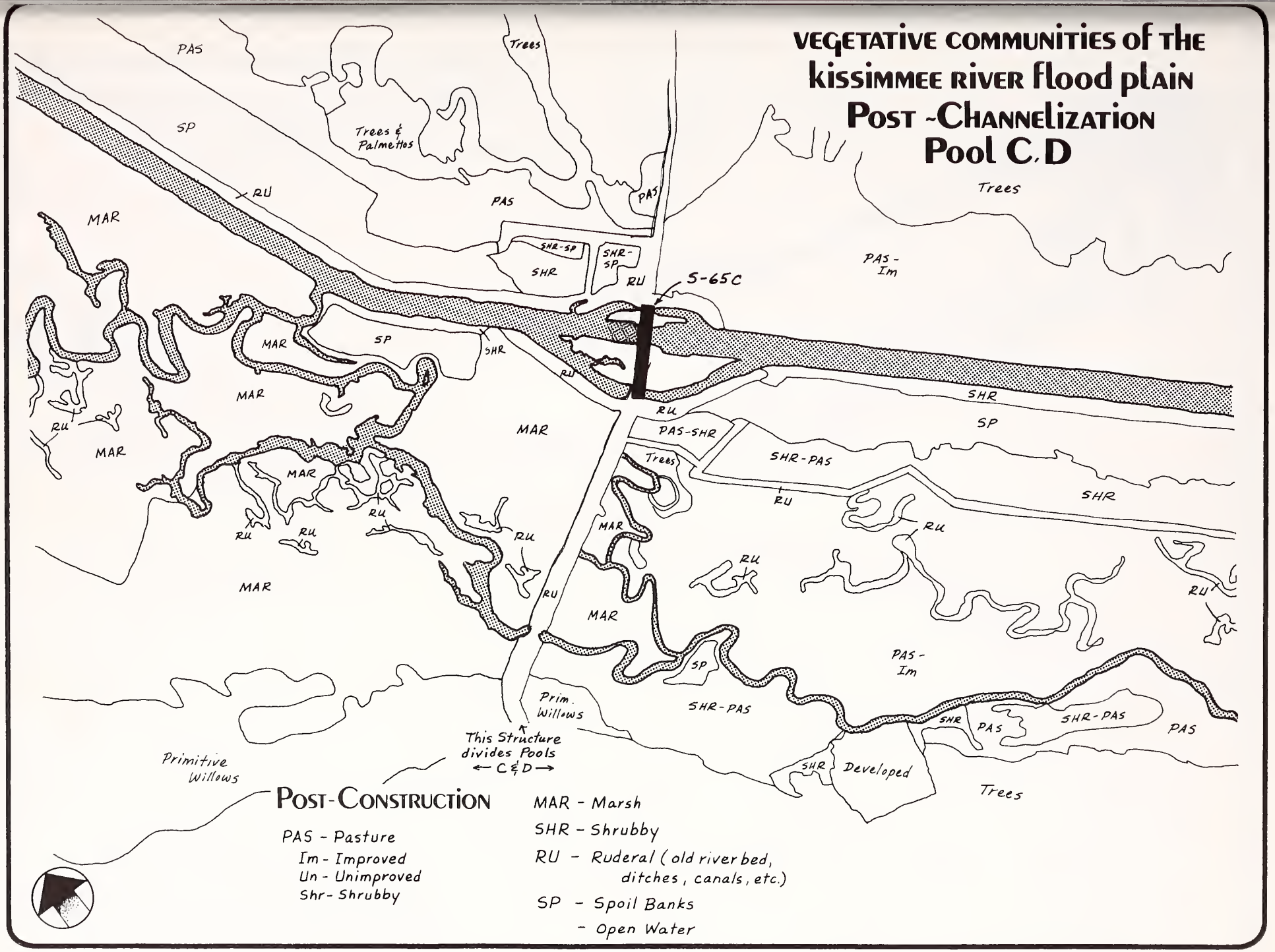
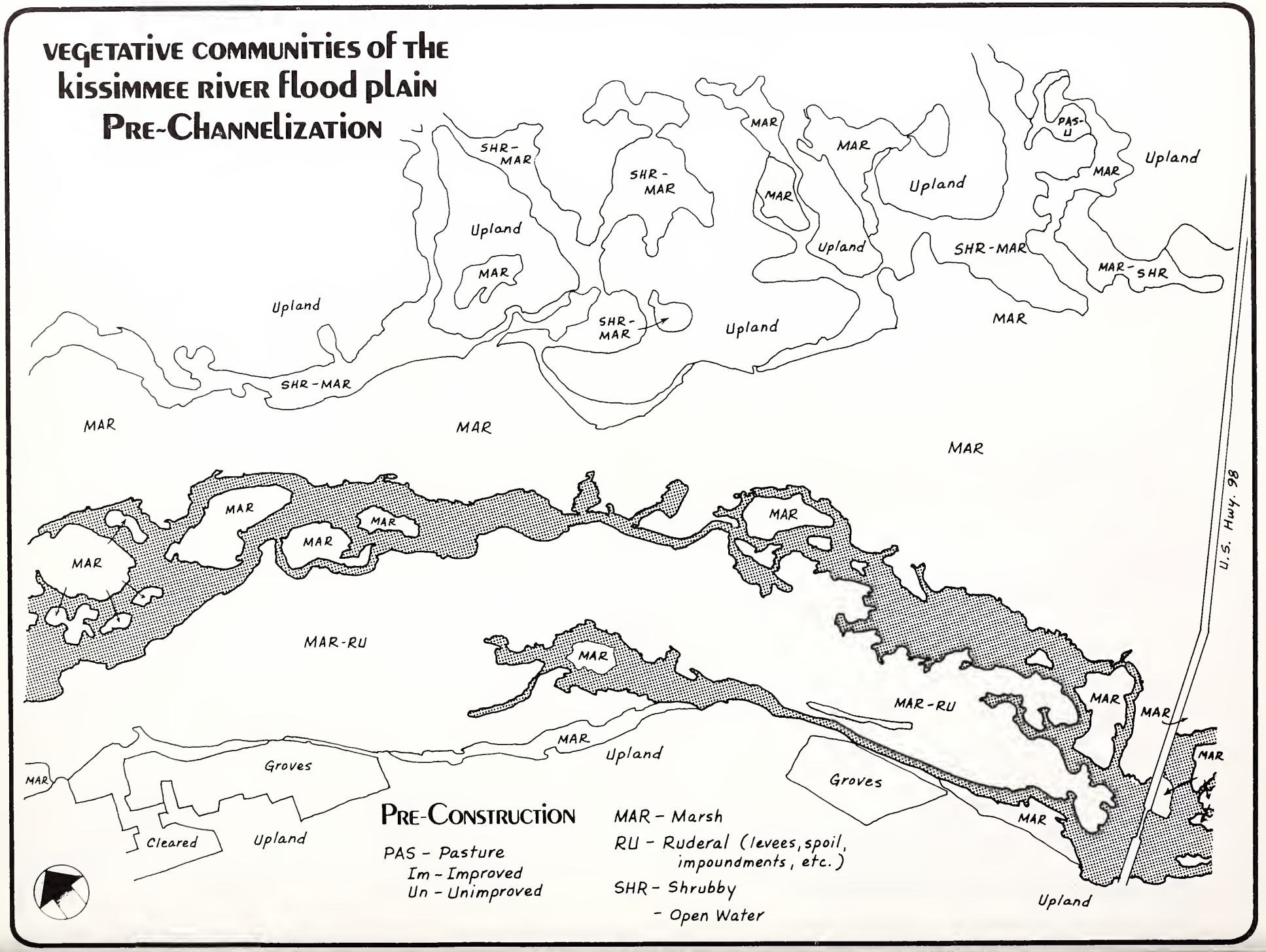

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
Post -Channelization
Pool C, D
PAS
Trees
SP
Trees & Palmettos
PAS
PAS
RU
MAR
SHR-SP
SHR
SHR-SP
RU
S-65C
Trees
PAS-Im
MAR
SP
SHR
RU
MAR
RU
MAR
MAR
RU
SHR
SP
RU
PAS-SHR
Trees
SHR-PAS
RU
SHR
MAR
RU
RU
RU
RU
RU
RU
MAR
RU
MAR
RU
PAS-Im
SP
Prim. Willows
SHR-PAS
This Structure divides Pools ← C & D →
SHR
PAS
SHR-PAS
PAS
Primitive Willows
SHR
Developed
Trees
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr- Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 14b


VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
SHR-MAR
SHR-MAR
MAR
MAR
PAS-U
Upland
MAR
Upland
Upland
MAR
Upland
SHR-MAR
MAR-SHR
MAR
SHR-MAR
Upland
MAR
Upland
SHR-MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR-RU
MAR
MAR-RU
MAR
MAR
MAR
MAR
Upland
Groves
MAR
Groves
Cleared
Upland
MAR
Upland
U.S. Hwy. 98
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water

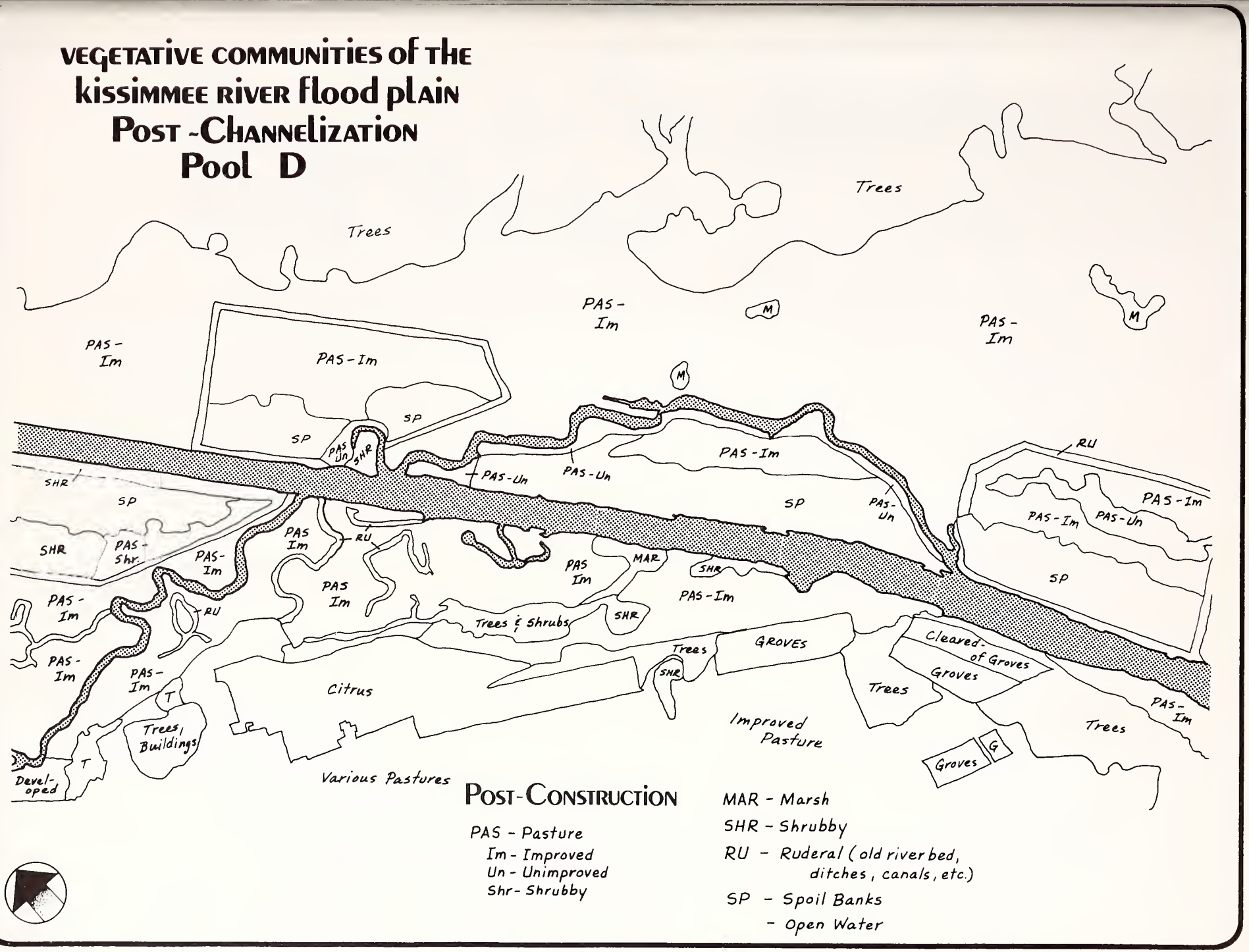
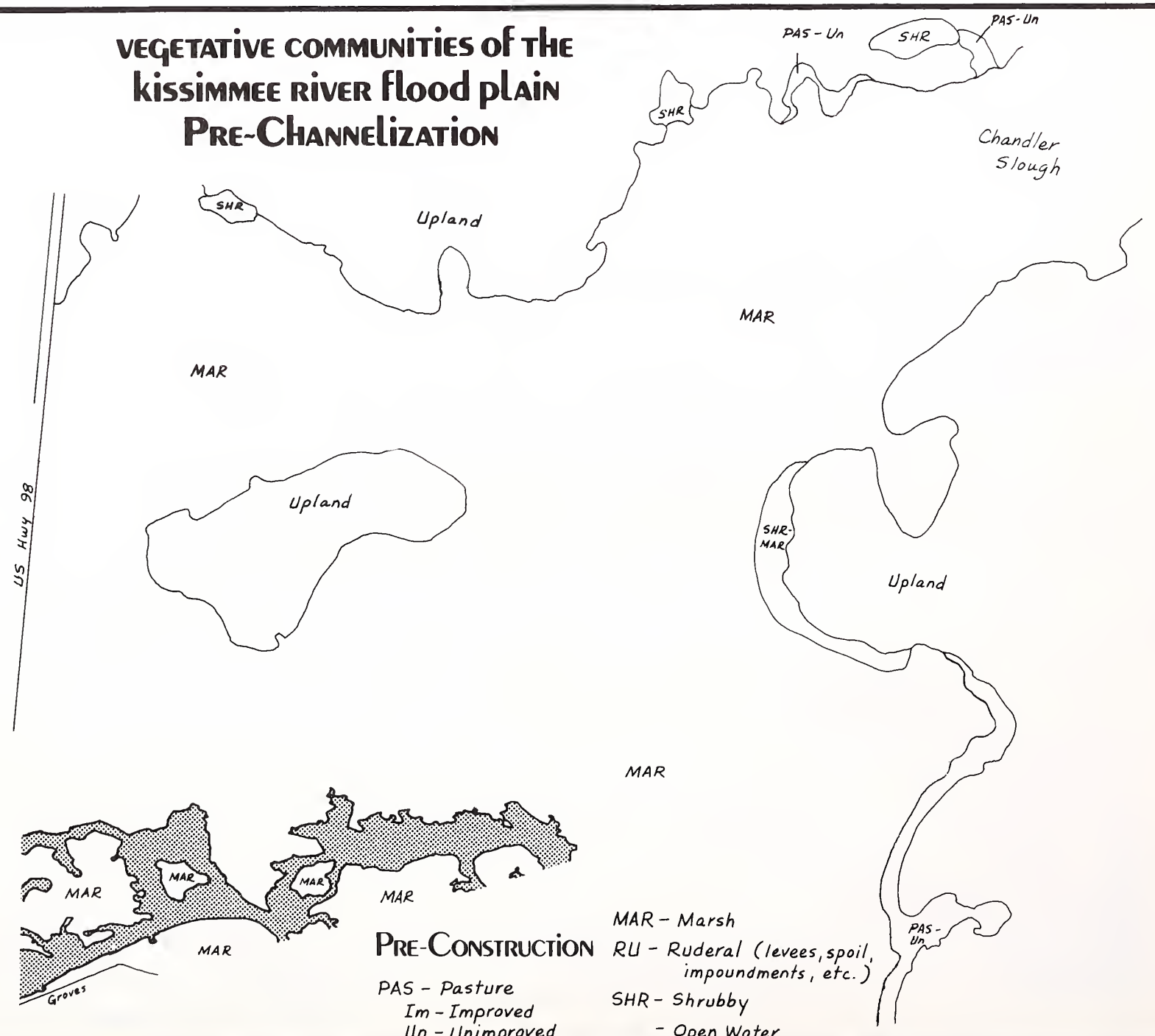

VEGETATIVE COMMUNITIES OF THE
kissimmee river flood plain
POST -CHANNELIZATION
Pool D
Trees
Trees
PAS - Im
PAS - Im
PAS - Im
PAS - Im
PAS - Im
M
M
M
SP
SP
PAS Un
SHR
PAS - Un
PAS - Un
PAS - Im
SP
PAS - Un
RU
PAS - Im
PAS - Im
PAS - Un
SP
SHR
SHR
PAS - Shr.
PAS - Im
PAS Im
RU
PAS Im
PAS Im
MAR
SHR
PAS - Im
PAS - Im
RU
Trees & Shrubs
SHR
PAS - Im
PAS - Im
Trees
GROVES
Cleared - of Groves
Groves
Citrus
SHR
Trees
PAS - Im
T
Trees
Improved Pasture
Trees, Buildings
T
Trees
G
Groves
Devel - oped
Various Pastures
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 15b

VEGETATIVE COMMUNITIES OF THE kissimmee river flood plain PRE-CHANNELIZATION



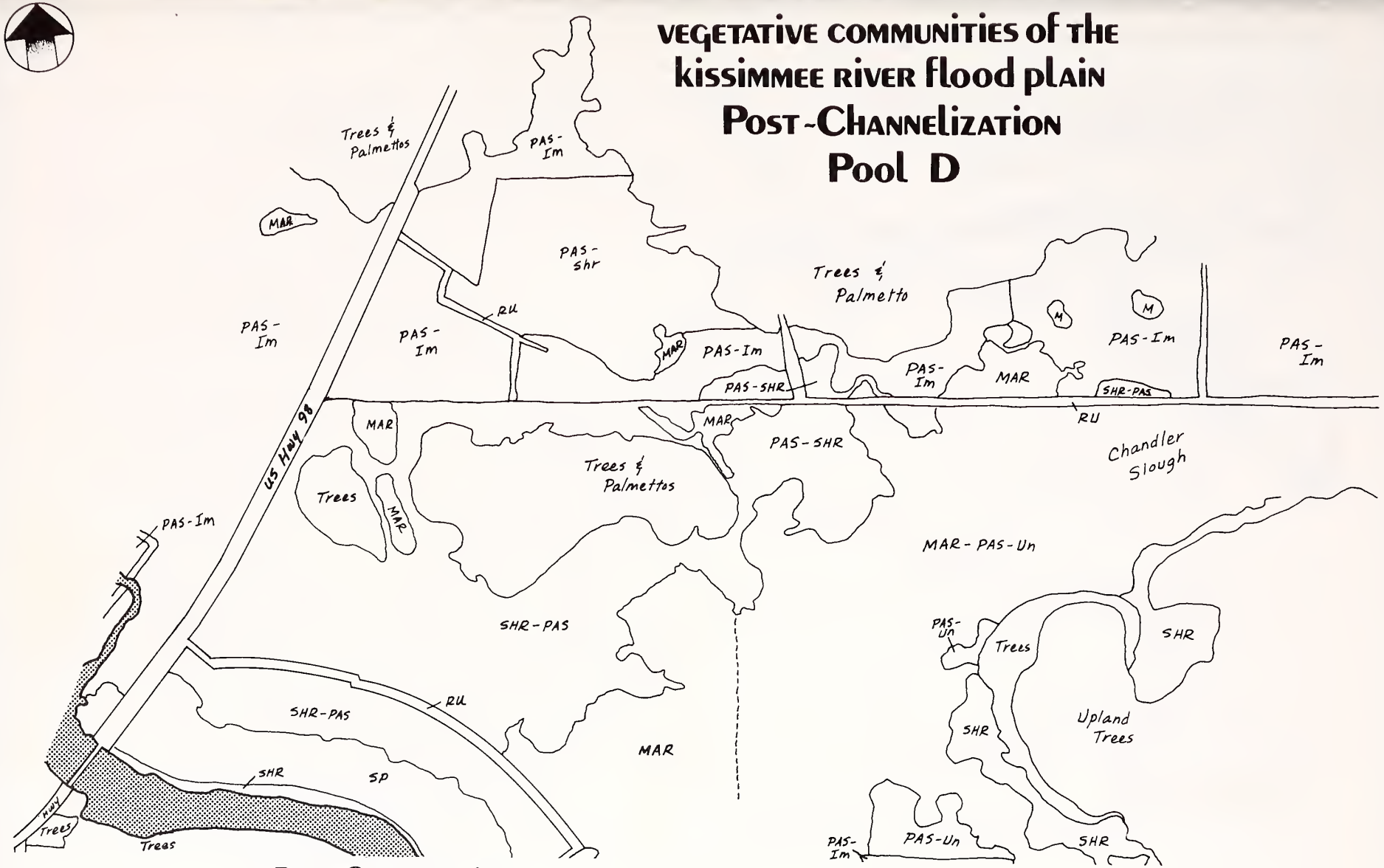
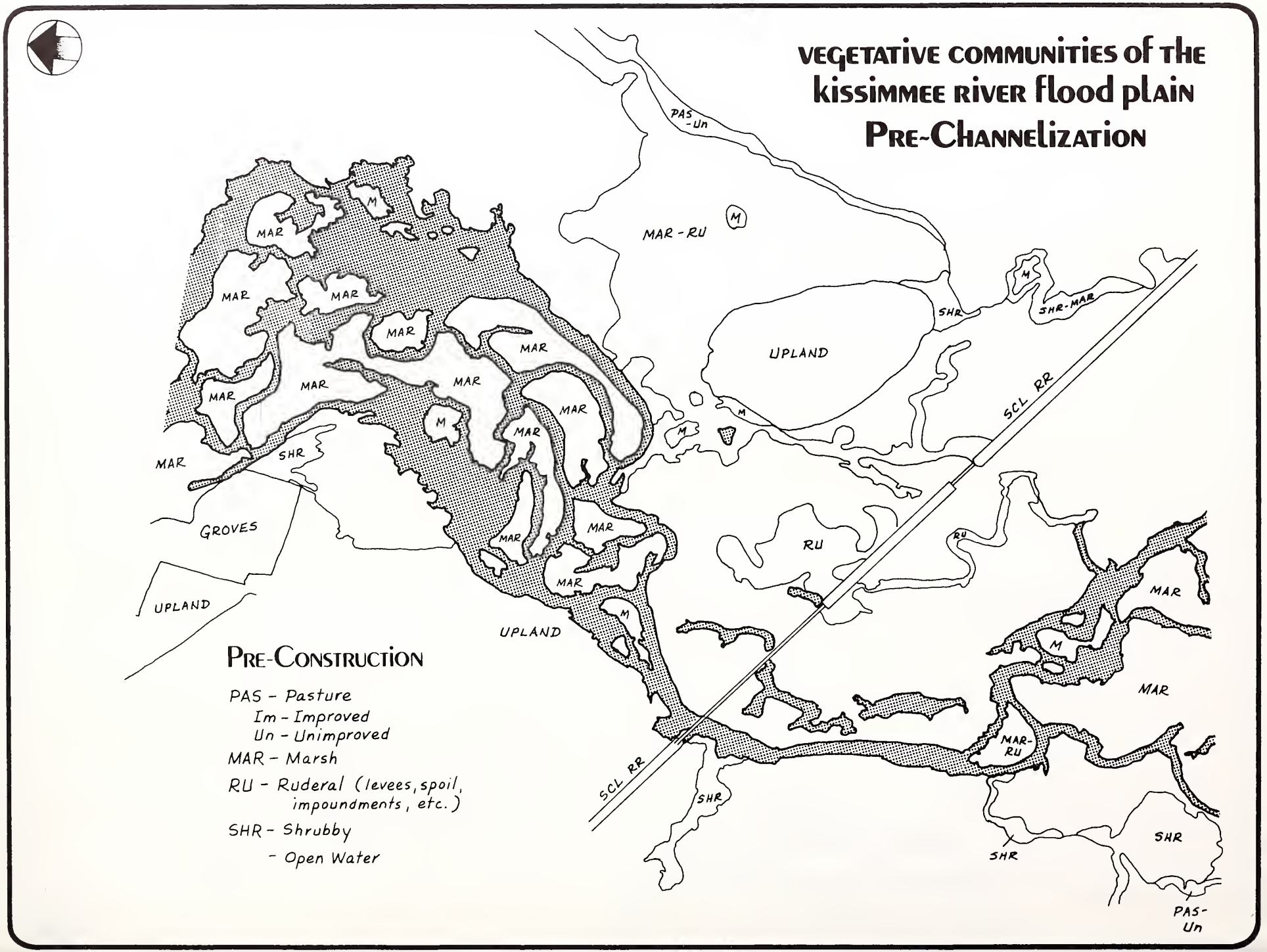

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
POST-CHANNELIZATION
POOL D
Trees & Palmettos
PAS-Im
MAR
PAS-shr
RU
PAS-Im
PAS-Im
MAR
PAS-Im
Trees & Palmetto
M
M
PAS-Im
PAS-Im
PAS-Im
PAS-SHR
MAR
SHR-PAS
US Hwy 98
MAR
MAR
PAS-SHR
RU
Chandler Slough
Trees
MAR
Trees & Palmettos
PAS-Im
MAR-PAS-Un
SHR-PAS
PAS-Un
Trees
SHR
SHR-PAS
RU
SHR
Upland Trees
MAR
SHR
SP
Hwy
Trees
Treas
PAS-Im
PAS-Un
SHR
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 16b


VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
PRE-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
MAR - Marsh
RU - Ruderal (levees, spoil, impoundments, etc.)
SHR - Shrubby
- Open Water
PAS-Un
MAR-RU
UPLAND
SCL RR
SHR-MAR
GROVES
MAR
SHR
RU
M
MAR-RU
PAS-Un

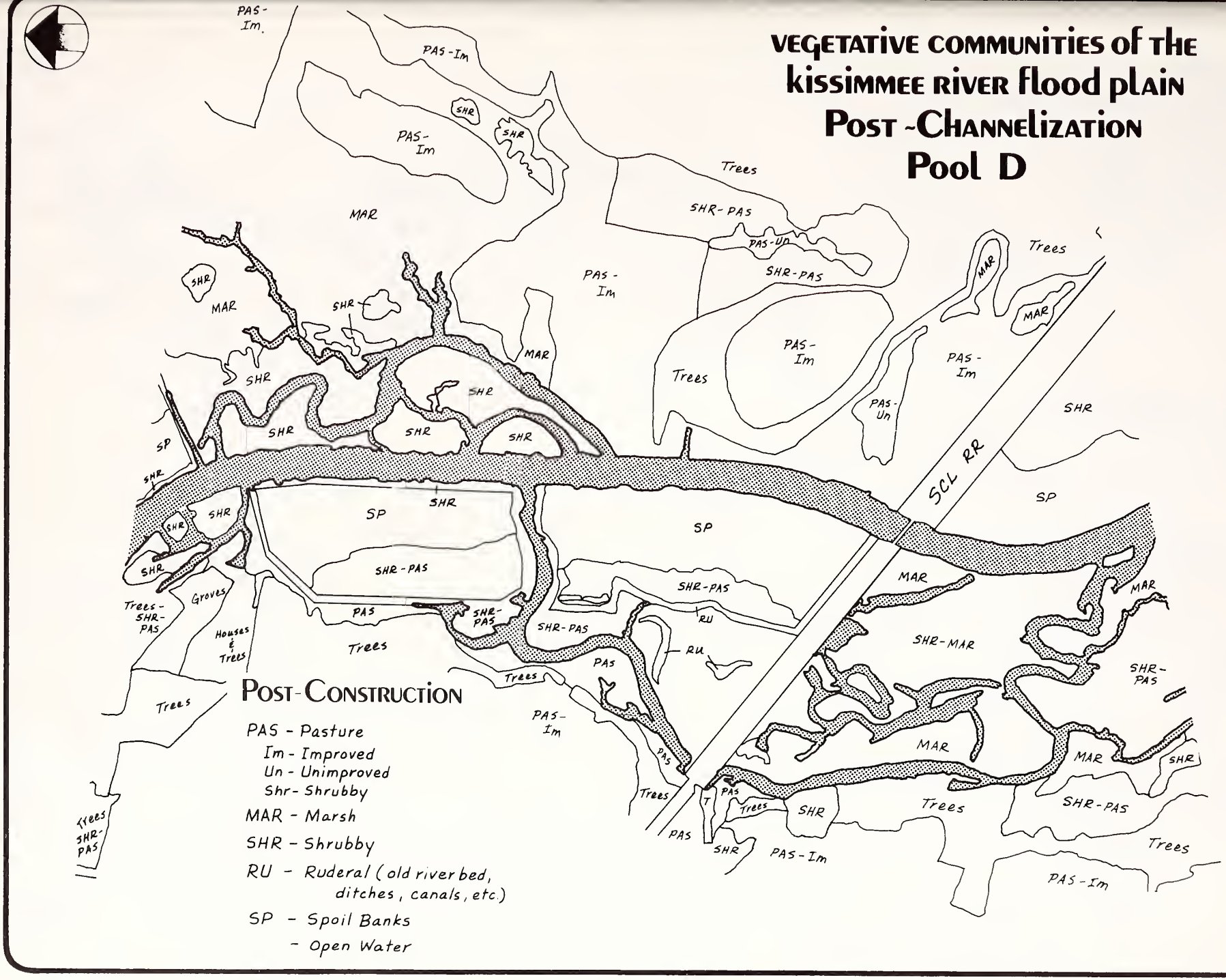
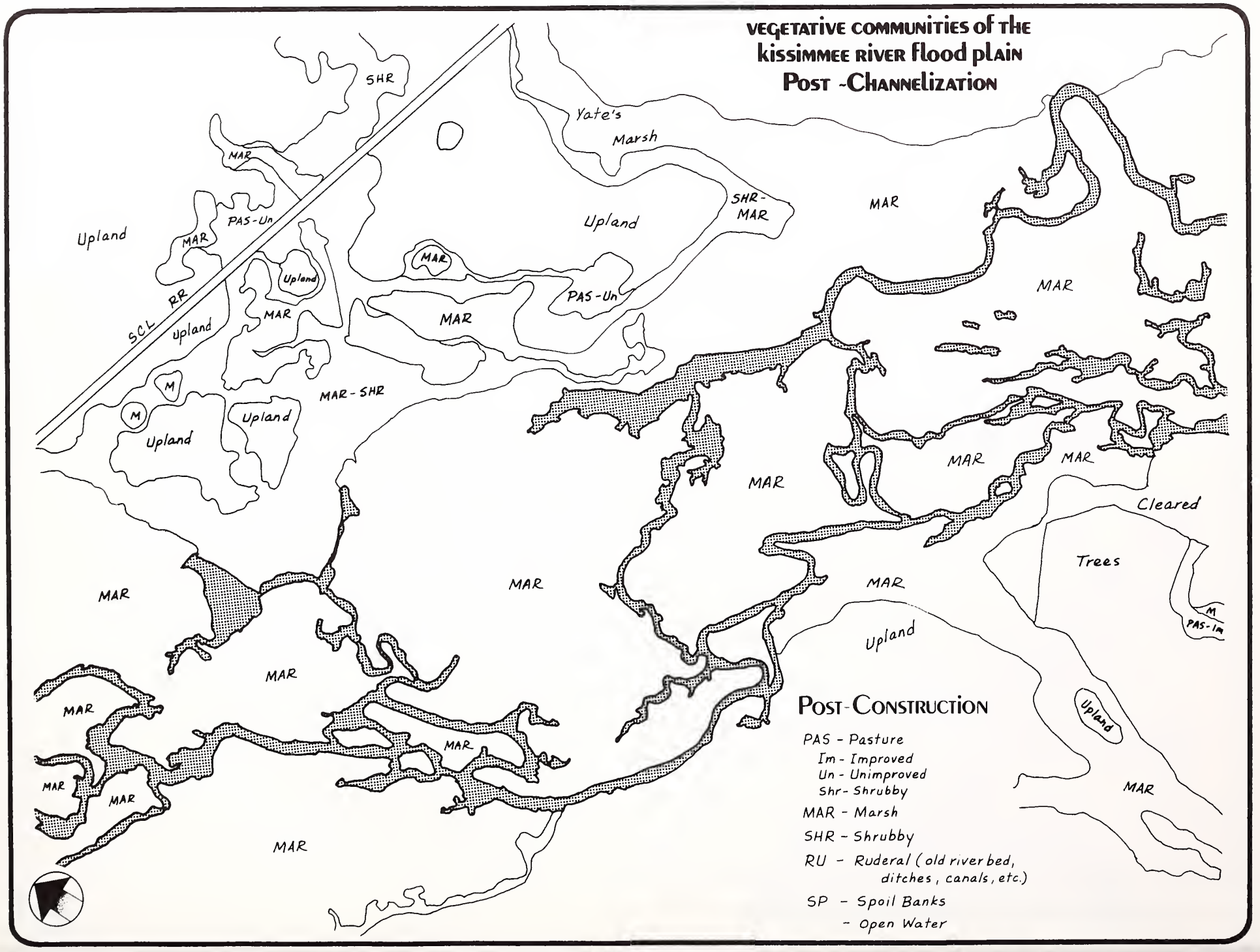

VEGETATIVE COMMUNITIES of the
kissimmee river flood plain
Post -Channelization
Pool D
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr- Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
SCL RR
PAS-Im
SHR
MAR
SHR-PAS
PAS-UD
PAS-Un
Trees
SP
RU
PAS
SHR-MAR
Groves
Houses & Trees
Trees-SHR-PAS

FIGURE 17b


VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
POST -CHANNELIZATION
SHR
Yate's
Marsh
MAR
SHR-
MAR
Upland
PAS-Un
MAR
Upland
MAR
SCL RR
Upland
MAR
MAR
PAS-Un
MAR-SHR
M
M
Upland
Upland
MAR
MAR
MAR
MAR
Cleared
Trees
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
MAR
Upland
M
PAS-Im
Upland
MAR
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr- Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

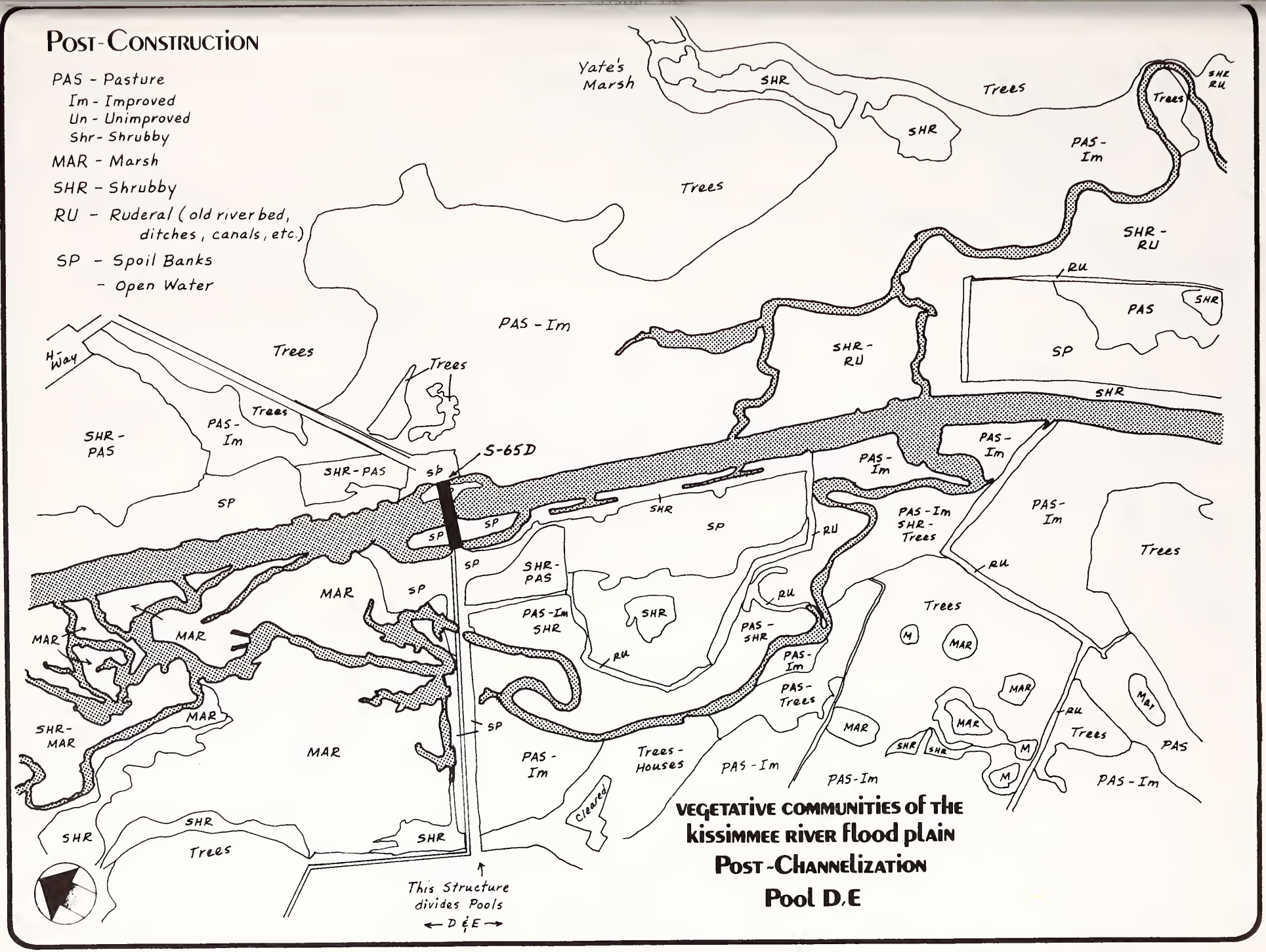
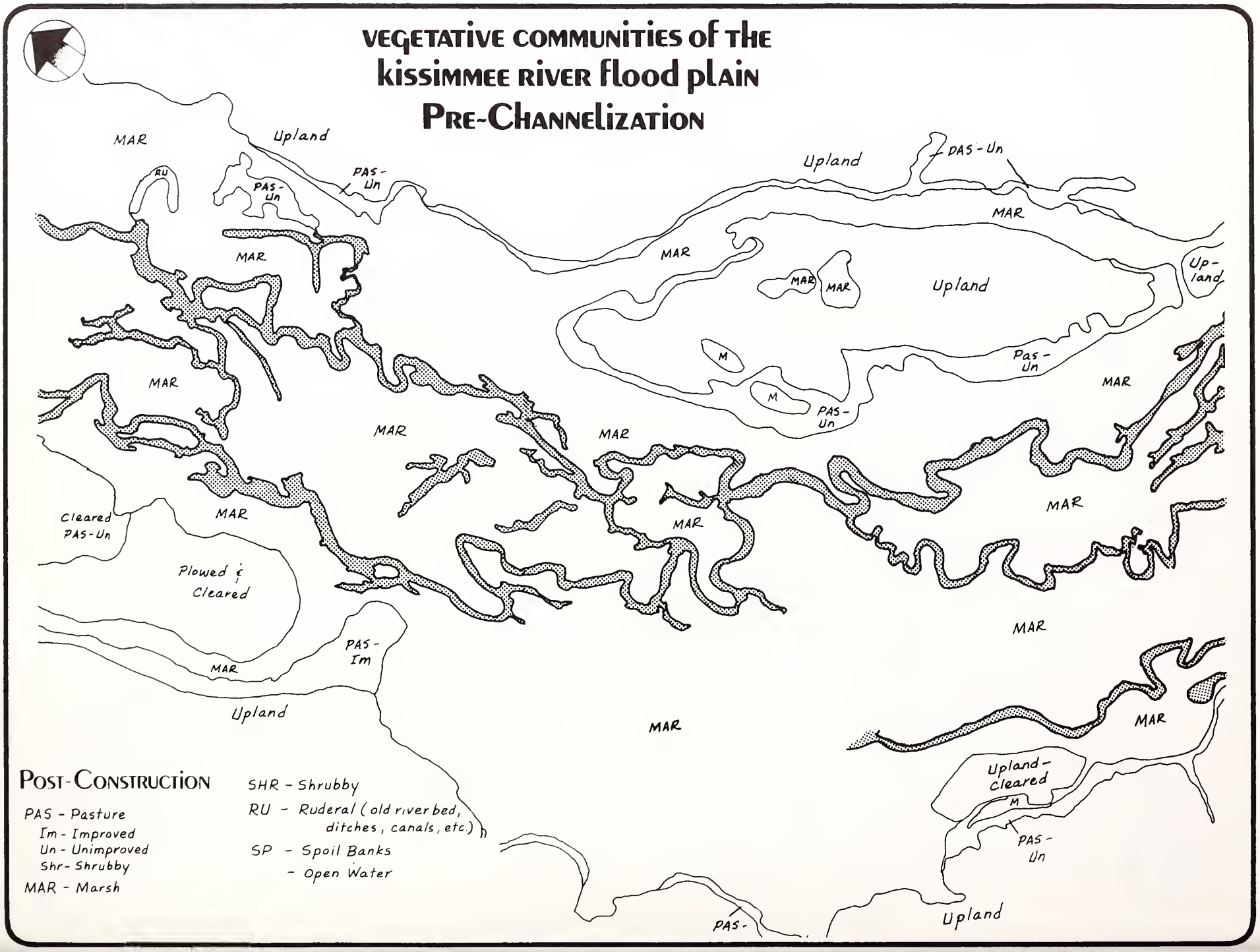

POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
Yate's Marsh
SHR
Trees
SHR RU
PAS - Im
SHR - RU
RU
PAS
SP
H Way
S-65D
sb
SHR - PAS
MAR
SHR - MAR
Cleared
Trees - Houses
PAS - SHR
PAS - Im SHR - Trees
M
This Structure divides Pools
← D & E →
VEGETATIVE COMMUNITIES of the kissimmee RIVER flood plain
POST-CHANNELIZATION
Pool D,E

FIGURE 18b


VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
PRE-CHANNELIZATION
MAR
Upland
RU
PAS - Un
MAR
Upland
PAS - Un
MAR
MAR
MAR
MAR
Upland
Up-land
M
Pas - Un
MAR
M
PAS - Un
MAR
MAR
MAR
MAR
MAR
Cleared PAS-Un
Plowed & Cleared
MAR
PAS - Im
MAR
Upland
MAR
MAR
Upland - cleared
M
PAS - Un
PAS -
Upland
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

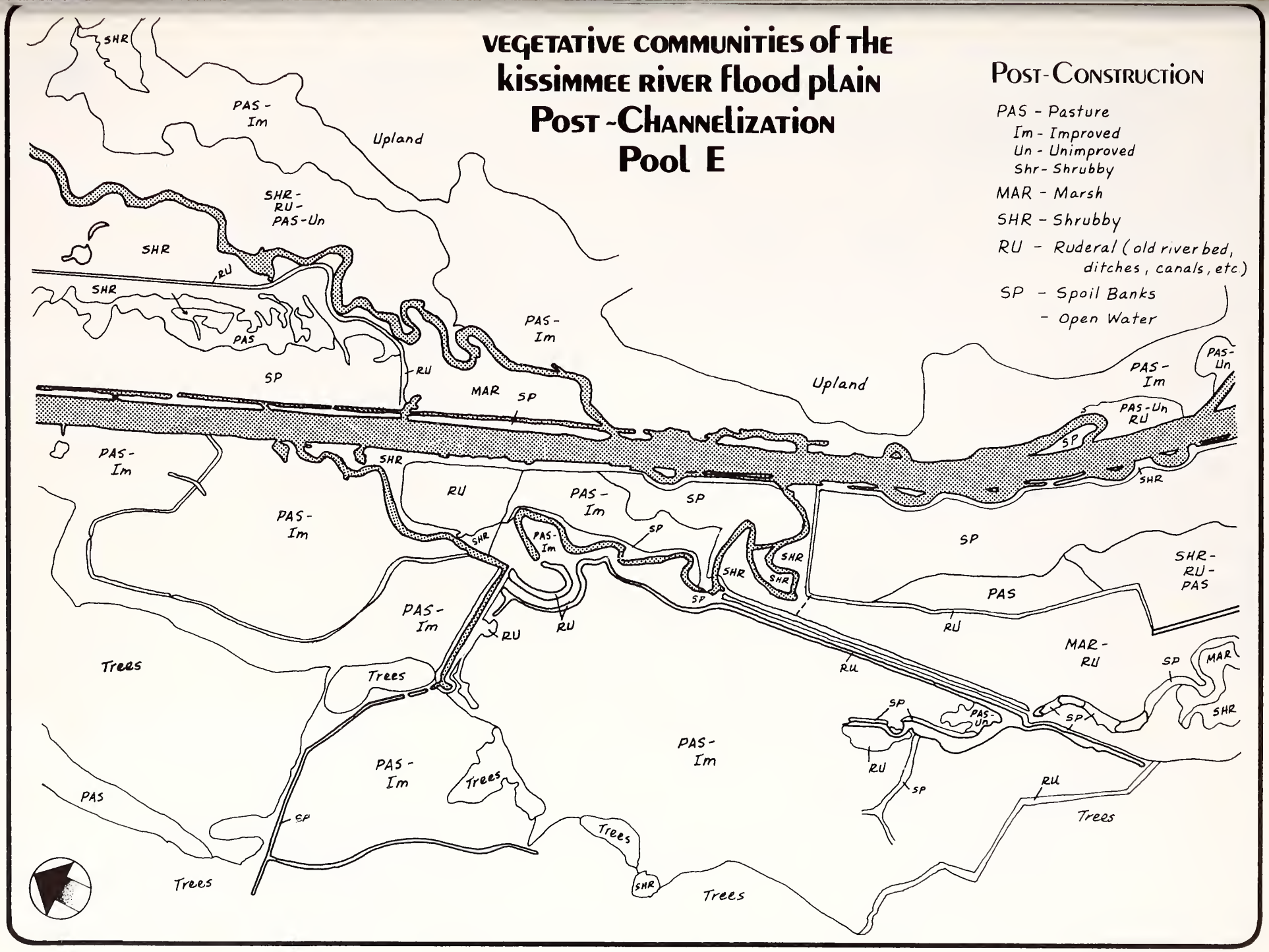
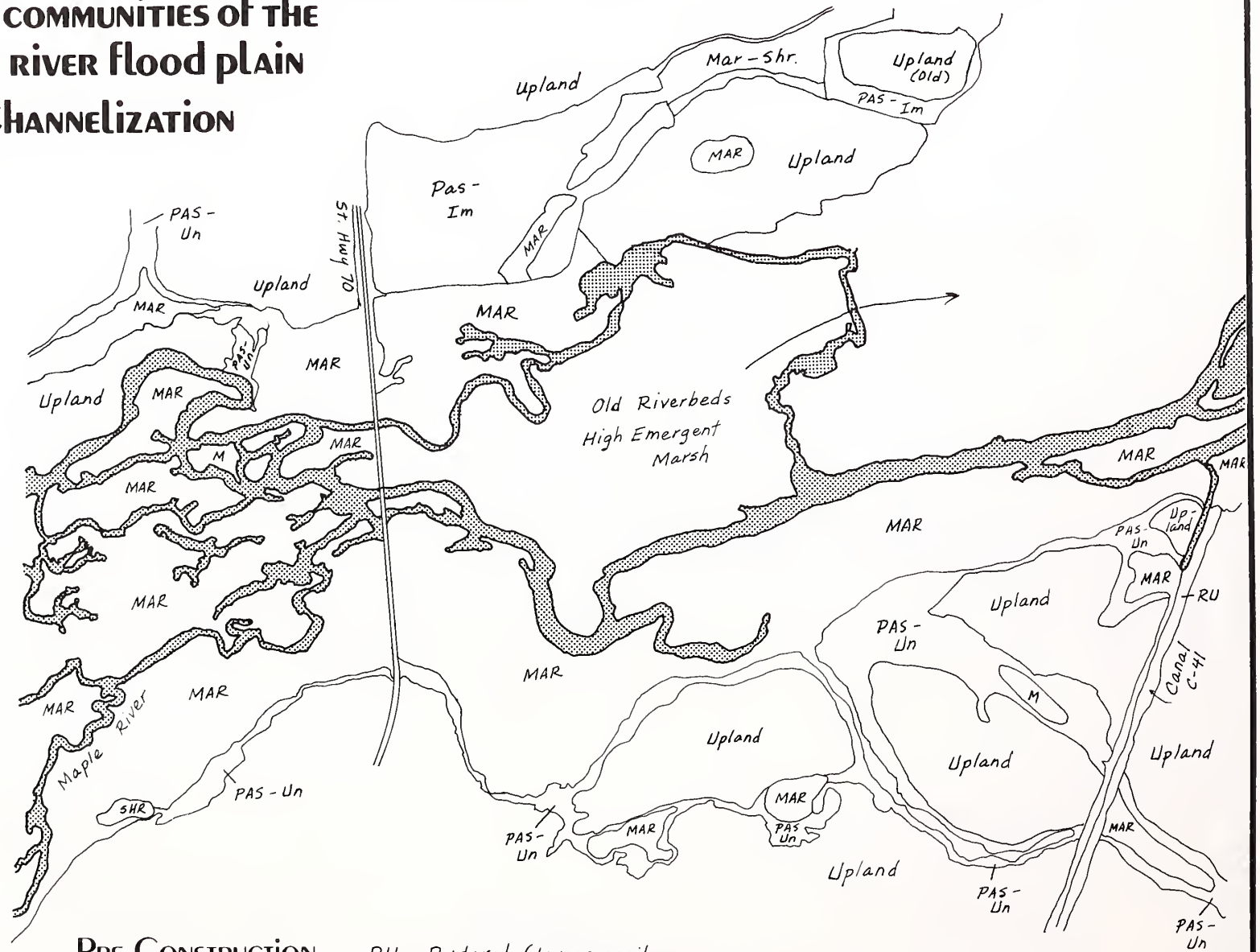

VEGETATIVE COMMUNITIES OF THE
kissimmee RIVER flood plain
POST-CHANNELIZATION
Pool E
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water
SHR
PAS - Im
Upland
SHR - RU - PAS-Un
SHR
RU
SHR
PAS
SP
RU
PAS - Im
MAR
SP
Upland
PAS - Im
PAS-Un
PAS-Un RU
SP
SHR
PAS - Im
SHR
RU
PAS - Im
SP
PAS - Im
SHR
PAS - Im
SP
SP
SHR
SHR
SHR
SHR - RU - PAS
SP
PAS
RU
PAS - Im
RU
RU
RU
MAR - RU
SP
MAR
SHR
Trees
Trees
SP
PAS-Un
SP
PAS - Im
RU
SP
RU
PAS - Im
Trees
Trees
PAS
SP
Trees
SHR
Trees
Trees

FIGURE 19b

VEGETATIVE COMMUNITIES of the kissimmee river flood plain

PRE-CHANNELIZATION



PRE-CONSTRUCTION

PAS - Pasture
- Im - Improved
- Un - Unimproved

MAR - Marsh

RU - Ruderal (levees, spoil, impoundments, etc.)

SHR - Shrubby

- Open Water

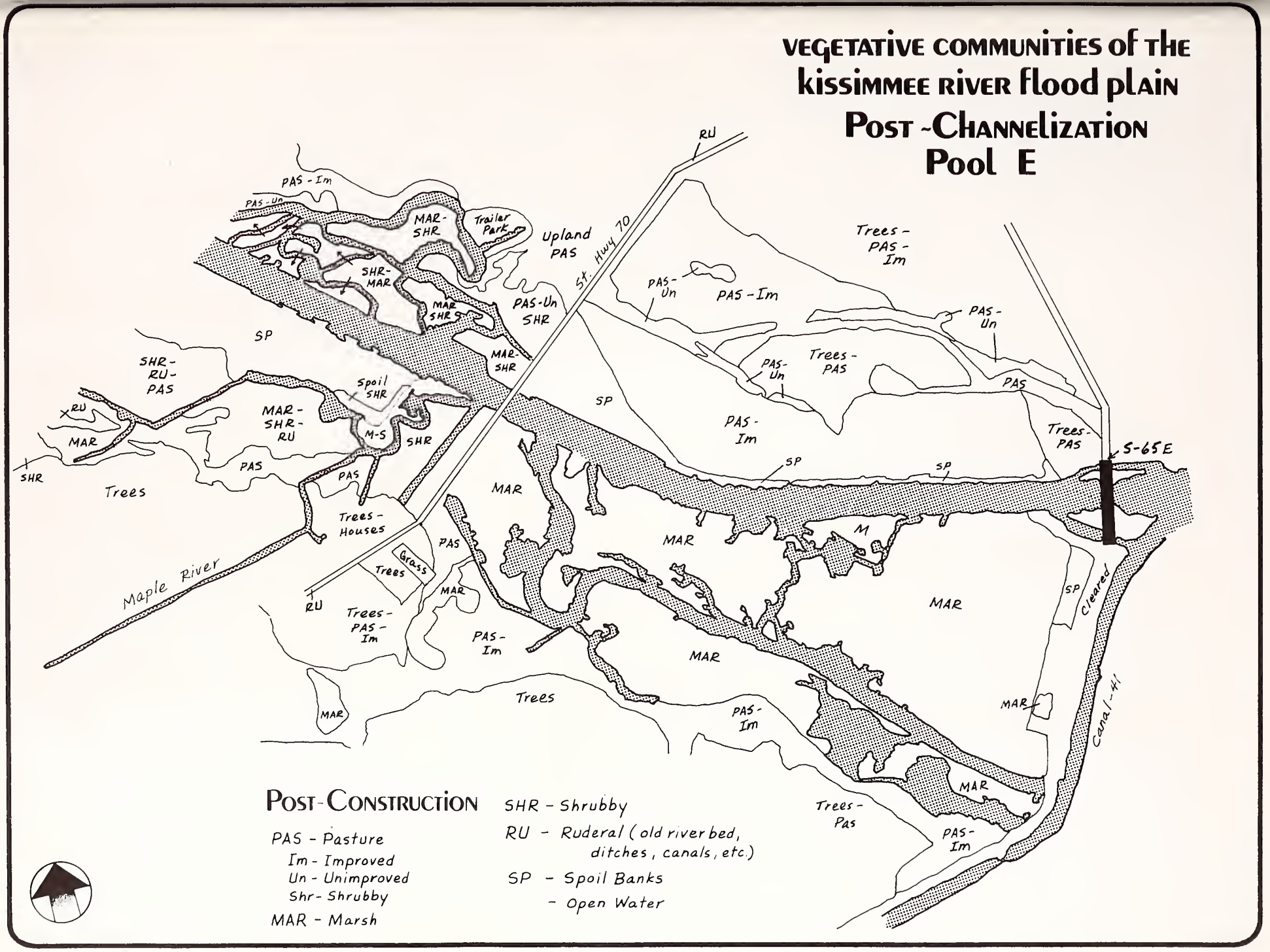

VEGETATIVE COMMUNITIES OF THE
KISSIMMEE RIVER FLOOD PLAIN
POST-CHANNELIZATION
POOL E
PAS - Im
PAS - Un
MAR - SHR
Trailer Park
Upland PAS
St. Hwy 70
RU
SHR - MAR
MAR SHR
PAS-Un SHR
SP
MAR - SHR
SHR - RU - PAS
Spoil SHR
MAR - SHR - RU
M-S
SHR
MAR
PAS
Trees
Trees - Houses
Grass
Maple River
Trees - PAS - Im
PAS - Im
Trees - PAS - Im
PAS - Un
PAS - Im
PAS - Un
Trees - PAS
PAS - Un
PAS
SP
PAS - Im
Trees - PAS
S-65E
SP
SP
MAR
M
MAR
MAR
SP
Cleared
Canal-41
MAR
Trees
PAS - Im
MAR
Trees - Pas
PAS - Im
MAR
POST-CONSTRUCTION
PAS - Pasture
Im - Improved
Un - Unimproved
Shr - Shrubby
MAR - Marsh
SHR - Shrubby
RU - Ruderal (old river bed, ditches, canals, etc.)
SP - Spoil Banks
- Open Water

FIGURE 20b